

# Modern Refrigeration & Air Control

Vol. 63 No. 743

FEBRUARY, 1960

Price 2s. 6d. monthly

## REFRIGERATION INSULATION

We Build

STANDARDS  
OF  
QUALITY

and Insulate

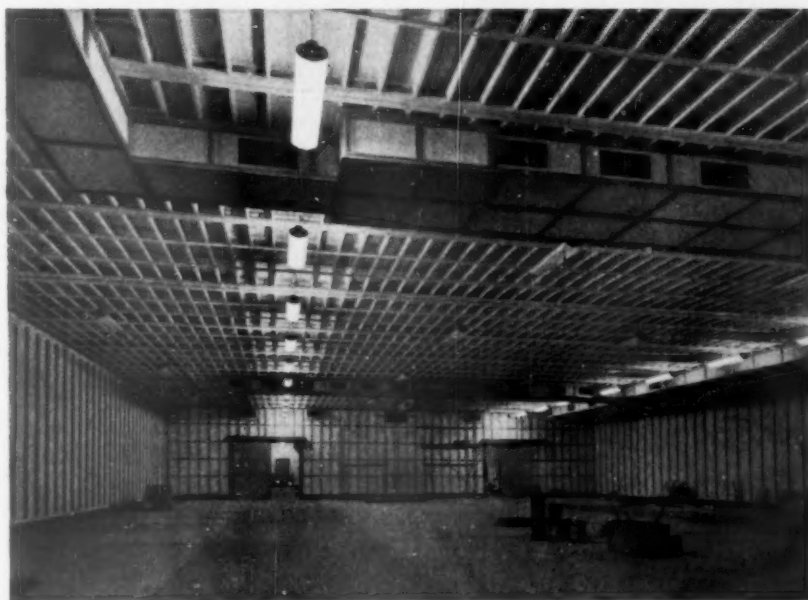
*Taylors of Mitcham*  
Since 1890

Quality

Integrity

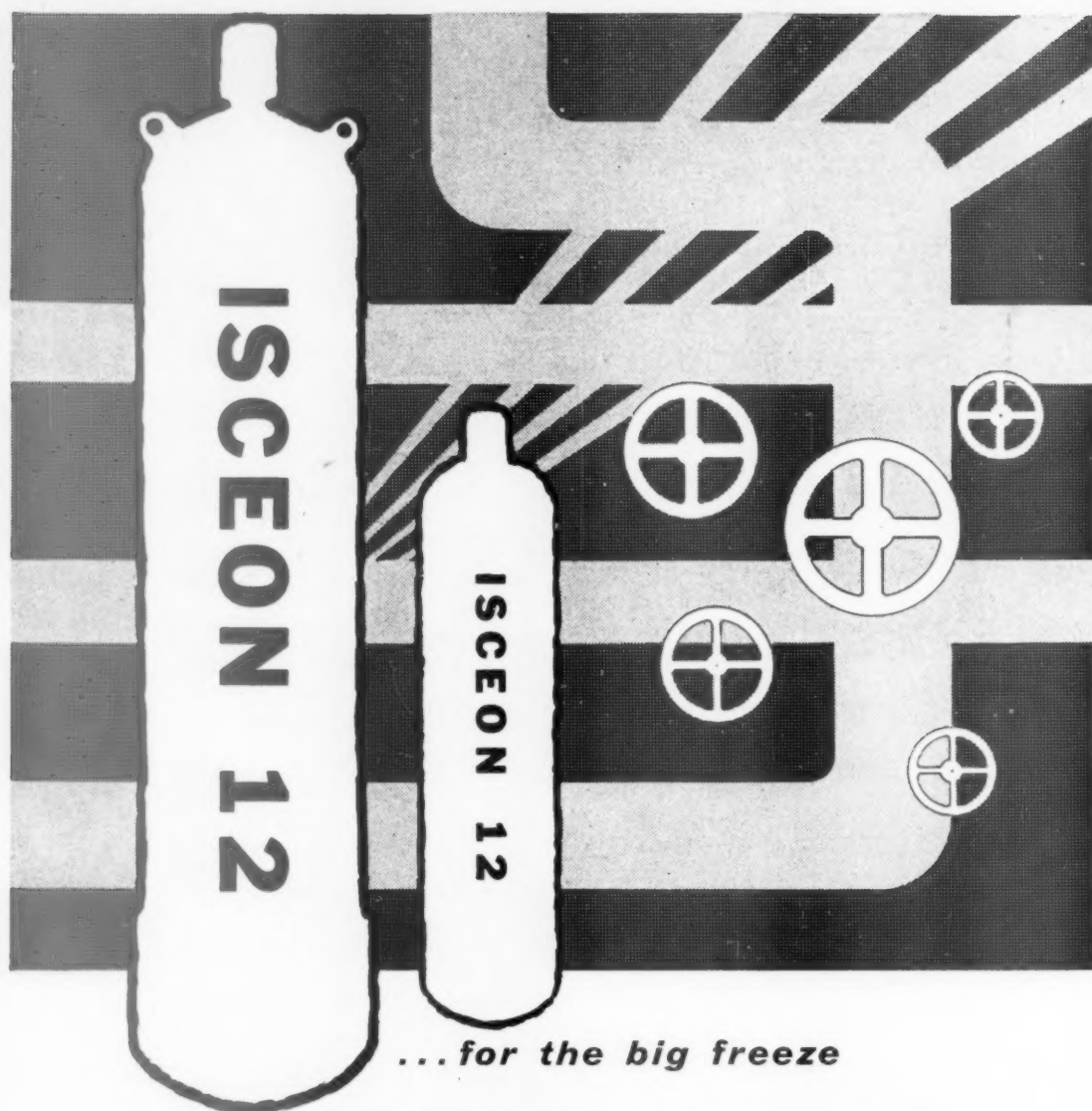
Efficiency

Experience



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Head Office: PITCAIRN ROAD, MITCHAM, SURREY, ENGLAND. Telephone: MITCHAM 6161 (5 lines). Works: CRUSOE ROAD and SWAINS ROAD, MITCHAM  
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***... for the big freeze***

In the big industries, large-size refrigeration and cold security are needed to cover vast areas. In abattoirs, for instance, refrigeration ships, or mobile transport.

ISCEON 12 protects as well as preserves, and is the safest because it's non-inflammable, non-combustible, non-toxic, and every container has undergone the rigours of the Imperial Smelting 7-test check.



CONSOLIDATED ZINC CORPORATION (SALES) LIMITED  
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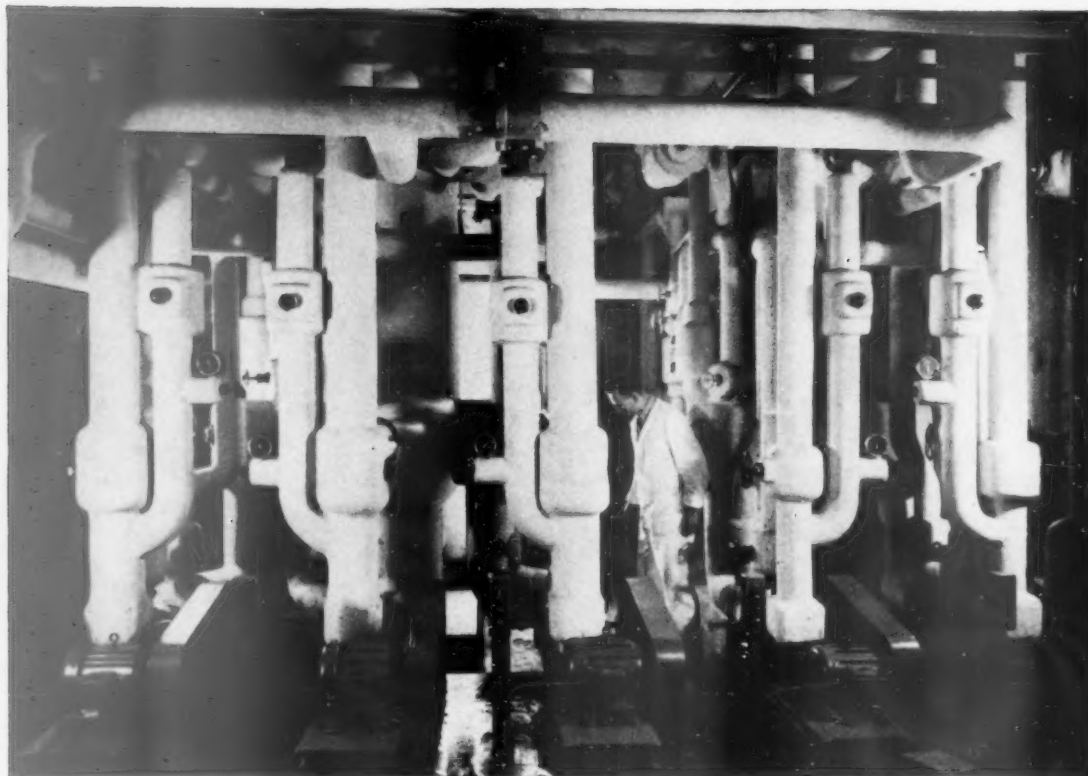
... that old vacuum forming machine again. Makes you sick. Weep. Lose contracts. Lose customers... Lose head too? No! Don't despair. Not your fault. Old machines always the same. Toil and trouble. Only one thing to do. Install a DANIELS. For absolute reliability. For non-stop output of long-contract work. For keeping customers... and keeping them happy.

*Write immediately for Daniels "Gradonk-avoider" literature*

World's finest, latest and fastest Vacuum-forming machines for the refrigeration industry. Range includes machines from 30" x 30" to 80" x 50" sheet capacity.

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In this extremely advanced and well-equipped plant at Bridge Park, Greenford, Onazote pipe sections were exclusively used for insulating the thousands of feet of refrigeration pipe lines to the freezers and hardening tunnels, and also for insulating the ammonia vessels in the Engine Room. All the chilled water lines throughout the factory were also insulated with Onazote.

Onazote was chosen for its unrivalled insulation efficiency and low water vapour transmission. So valuable was the latter in this particular case that it was possible to put the ammonia lines into operation before the final vapour seal was applied.

**THERMAL CONDUCTIVITY**  
0.20 B.Th.U./sq.ft. hour °F/inch  
at a mean temp. of 50°F.

**WATER VAPOUR TRANSMISSION**  
at 100°F (38°C) and 1-90%  
relative humidity.  
1.58 grains/sq.ft./24 hr./2 in.

installation throughout was by

**ONAZOTE INSULATION COMPANY LTD**

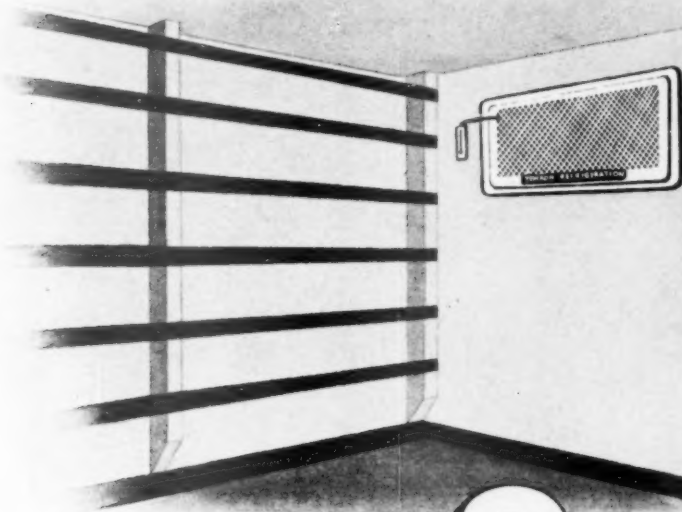
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Subsidiary of Expanded Rubber Co Ltd A member company of The British Xylonite group

VISIT US AT STANDS 66 AND 67 REFRIGERATION EXHIBITION, ROYAL HORTICULTURAL HALL, FEB. 15 - 17



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complete  
for only

# £180

Only **TEMKON** *Packaged Units make this possible!*

They are completely self-contained — are delivered factory wired and piped for easy, low-cost installation — supplied with installation kit.

- ★ Low temperature range  $-15^{\circ}\text{F}$  to  $+38^{\circ}\text{F}$ .
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- ★  $1\frac{1}{2}$  Horse power.
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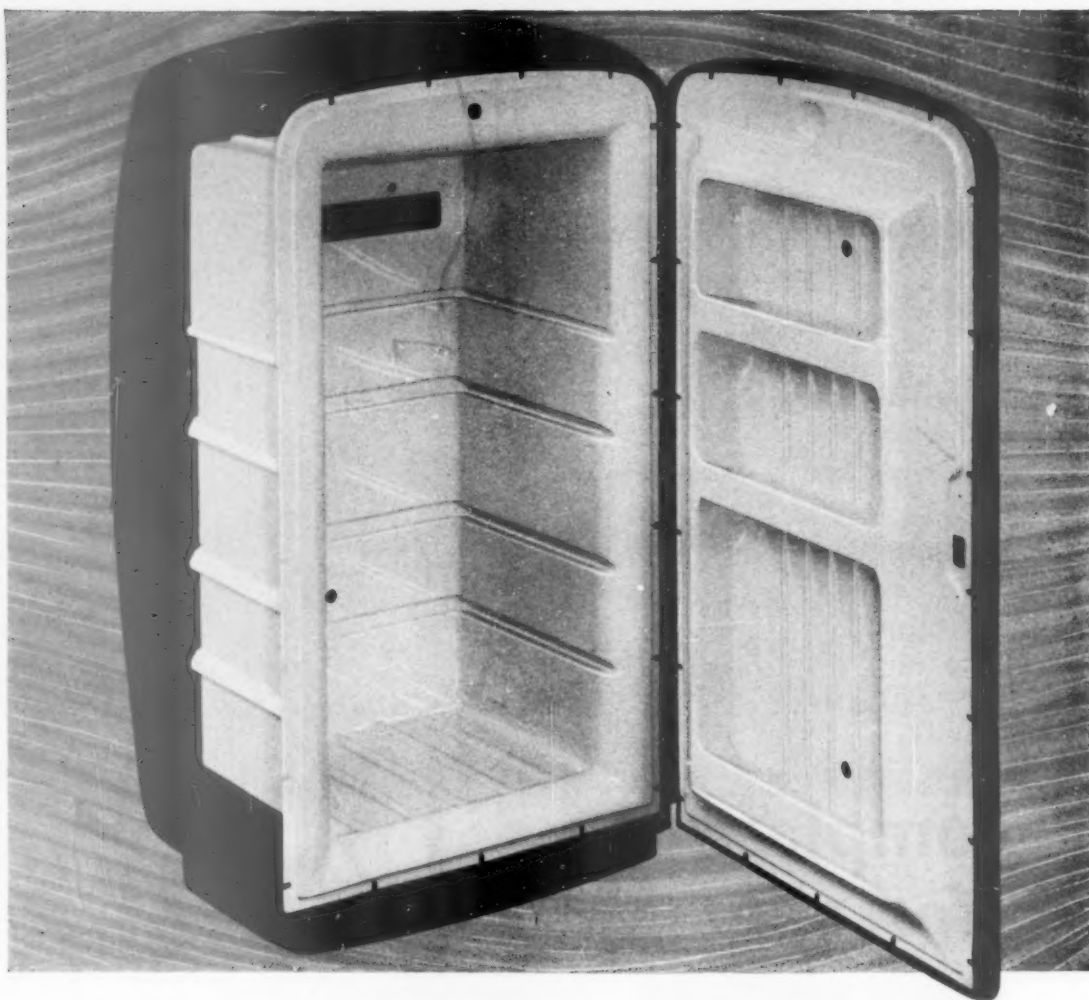
AND GET FULL DETAILS OF THIS  
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POSITION \_\_\_\_\_

COMPANY'S NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_



## Streamlined linings

This complete inner and the door lining for the Astral refrigerator are vacuum-formed, in Bextrene toughened polystyrene sheet.

Refrigerator inner and  
door lining by  
Thermoplastics Ltd  
Dunstable

This is extruded from granules of BEXTRENE BC15 high impact polystyrene — more than four times as tough as general purpose polystyrene.

It is ideally suited for thermo-forming either by draw-forming or vacuum-forming or by a combination of these processes. Owing to the high yield, Bextrene Sheet is a most economical material to use. Its specific gravity is approximately 1.06

Bextrene's toughness, dimensional stability and chemical resistance make it a first class material for all types of semi-rigid packaging containers; display materials; component parts for radio and television sets; toys and decorative novelties.



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*Please write for technical data sheets on Bextrene sheet and Bextrene moulding powders.*

**BX PLASTICS LIMITED** A subsidiary of The British Xylonite Co Ltd

Cobex and Bextrene Sheet Sales Division, Manningtree, Essex  
Telephone : Manningtree 401

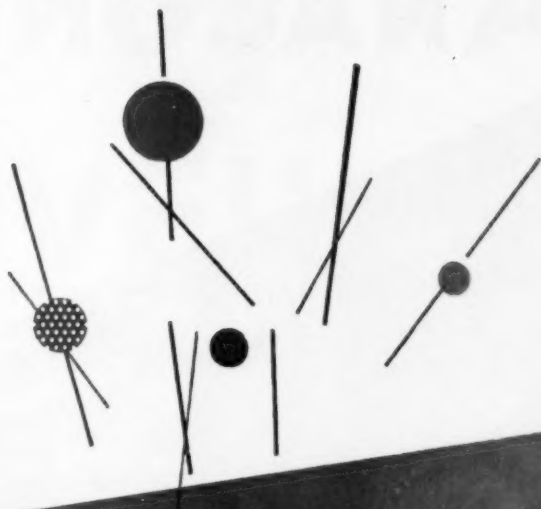
TA 2075

MODERN REFRIGERATION February 1960

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TRADE MARK

molecular sieves show . . .

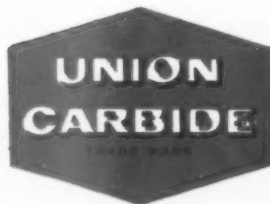
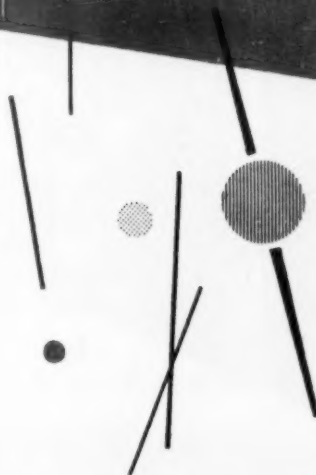
Dryers using Molecular Sieves adsorb five to ten times the moisture collected by silica-type desiccants. In addition, Molecular Sieves last longer . . . you will have fewer replacements to make; and because dryers can be made smaller, they are easier for you to carry . . . easier to stock . . . their compactness makes them easier to install. Unaffected by Oil or Refrigerant.



... the difference in **dryer** performance

UNION CARBIDE Molecular Sieves unique crystalline structure makes it impossible for them to become clogged with oil or refrigerant. The entire surface area is used to adsorb moisture . . . giving a longer and more effective life to every dryer.

For full information about grade availability and technical assistance please contact Section II-V.



molecular sieves

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IN  
THE  
WORLD

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# MINIVEIL

AIR CURTAIN UNIT

FOR OPEN COLD STORE DOORS



*For efficient Cold Storage operation*

The Minikay System keeps new insulation permanently dry and dries out existing wet insulation.

The Minikay System eliminates the heavy cost of re-insulation.

The Minikay System extends the life of your cold store to that of normal buildings. Cold Storage insulation is extremely valuable—protect it with Minikay.



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FOR PERMANENTLY DRY INSULATION



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LONDON, EC2

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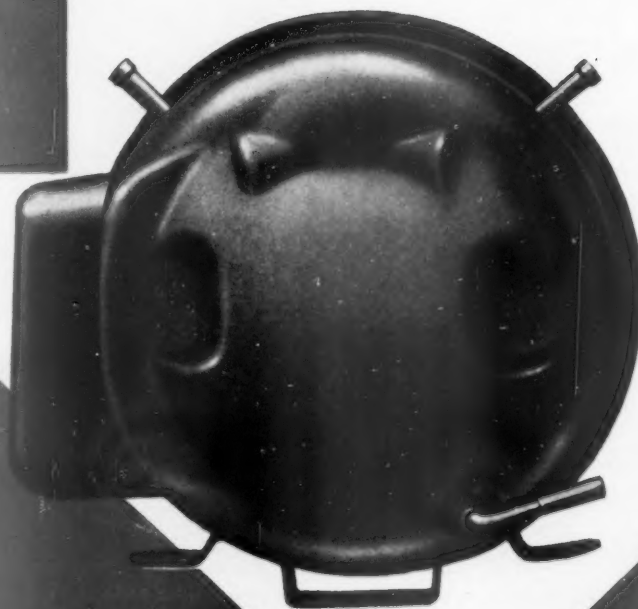
We shall be pleased to see you at Stand No. 13 at the Industrial and Commercial Refrigeration Exhibition, Royal Horticultural Hall, Feb. 15-17.

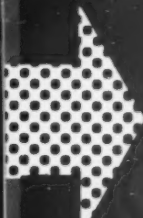


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# and increase your cabinet storage capacity by using the brilliant new high-speed pancake !

And now the high-speed A.P. 43 with 2 pole motor giving full  $\frac{1}{4}$  h.p. capacity for all applications. Manufacturers of home freezers, water coolers, dehumidifiers, beverage coolers and vending machines will be able to take advantage of the Pancake's compact size in their design, will gain needed space, and still retain top efficiency. Internal spring mountings, force feed lubrication, and a new specially designed piston give smoother, quieter operation.

The welded steel shell aided by the cooling action of the suction gas, and in some cases an oil cooler, makes for faster dissipation of heat and greater efficiency.

Consult us for complete information on how you can save time and money by standardising your production line with the flexible Tecumseh 'Pancake' Compressor.

*another product of Tecumseh engineering vision*



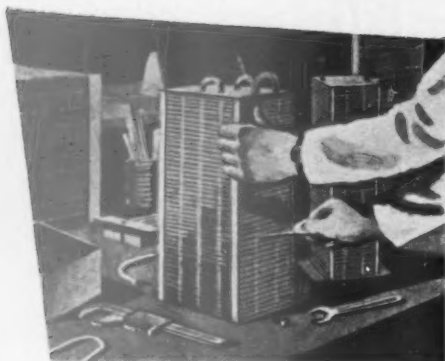
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**Make sure  
the efficiency  
you build . . .**

**. . . is built into**



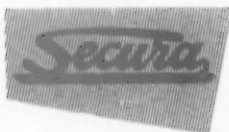
**cabinets**



Secura cabinets ensure peak performance from units ;  
with their faultless insulation and robust construction, they  
are built to match today's finest refrigeration equipment.  
As for appearance, you'll see for yourself that there is no  
better looking or easier-to-clean cabinet with white  
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All this, and yet the low cost will surprise you !

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**YORKSHIRE  
IMPERIAL**

**LIGHT GAUGE COPPER AND  
COPPER-ALLOY TUBES and  
"YORKSHIRE" CAPILLARY FITTINGS**

***for refrigeration and air-conditioning plant***

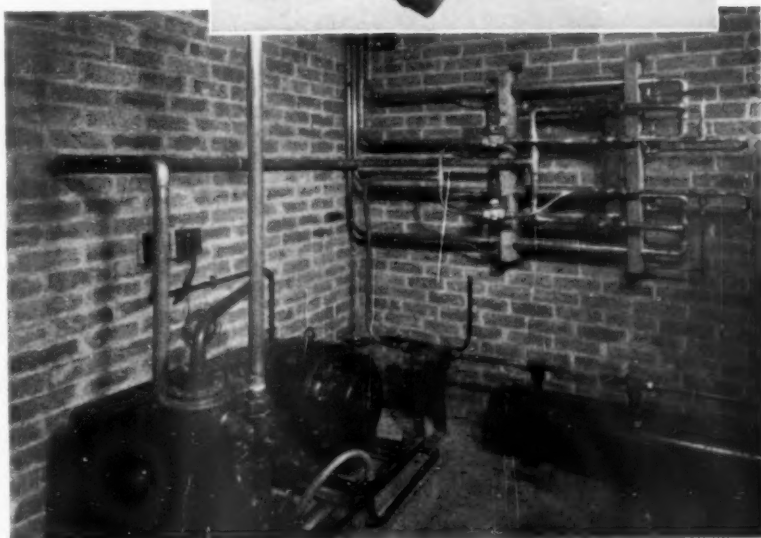
"Yorkshire" Capillary Fittings, incorporating tin-silver solder rings, are especially suitable for joining copper and copper-alloy tubes operating at low temperatures in refrigeration and other services.

They incorporate, as an integral part of the fitting, the correct amount of solder for making quick, sound and trouble-free joints which are proof against seepage by refrigeration gases and other fluids under pressure.

The appearance of a complete ring of solder at the mouth of the fitting is visual proof of a sound and reliable joint.



*Pipework arrangement—  
incorporating "Yorkshire"  
Fittings—in compressor  
room at the Birtley Factory  
of Messrs. Kraft Foods Ltd.  
(installation by Messrs. L.  
Sterne & Co. Ltd.)*



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**NEW**

## **REFRIGERATION TECHNIQUE**

Keeps food temptingly fresh, cuts operating costs.

## **VISUAL APPEAL**

Extra capacity ensures maximum stock on display. Full product visibility. Easy shopping angle.

## **PRODUCE PERFECTION**

Through precise temperature control with automatic defrosting.

## **STYLING AND COLOUR SCHEMES**

With warmed reach-in rail and ample storage room.

THE SELF SERVICE CASES WHICH ANTICIPATE  
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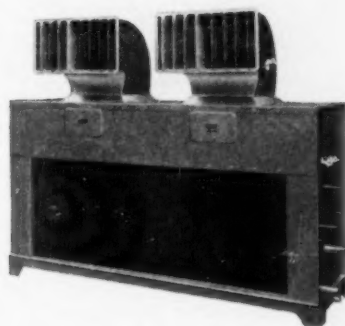
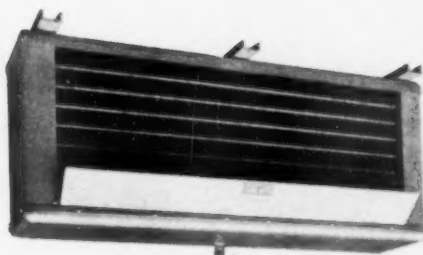
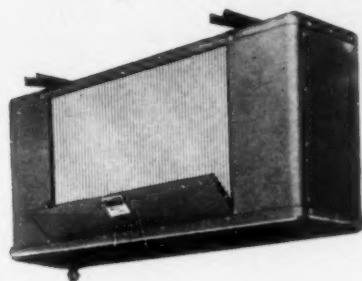
**SMITHFIELD REFRIGERATOR CO. LTD., 1 CROSS LANE, HIGH STREET, HORNSEY, LONDON, N.8**

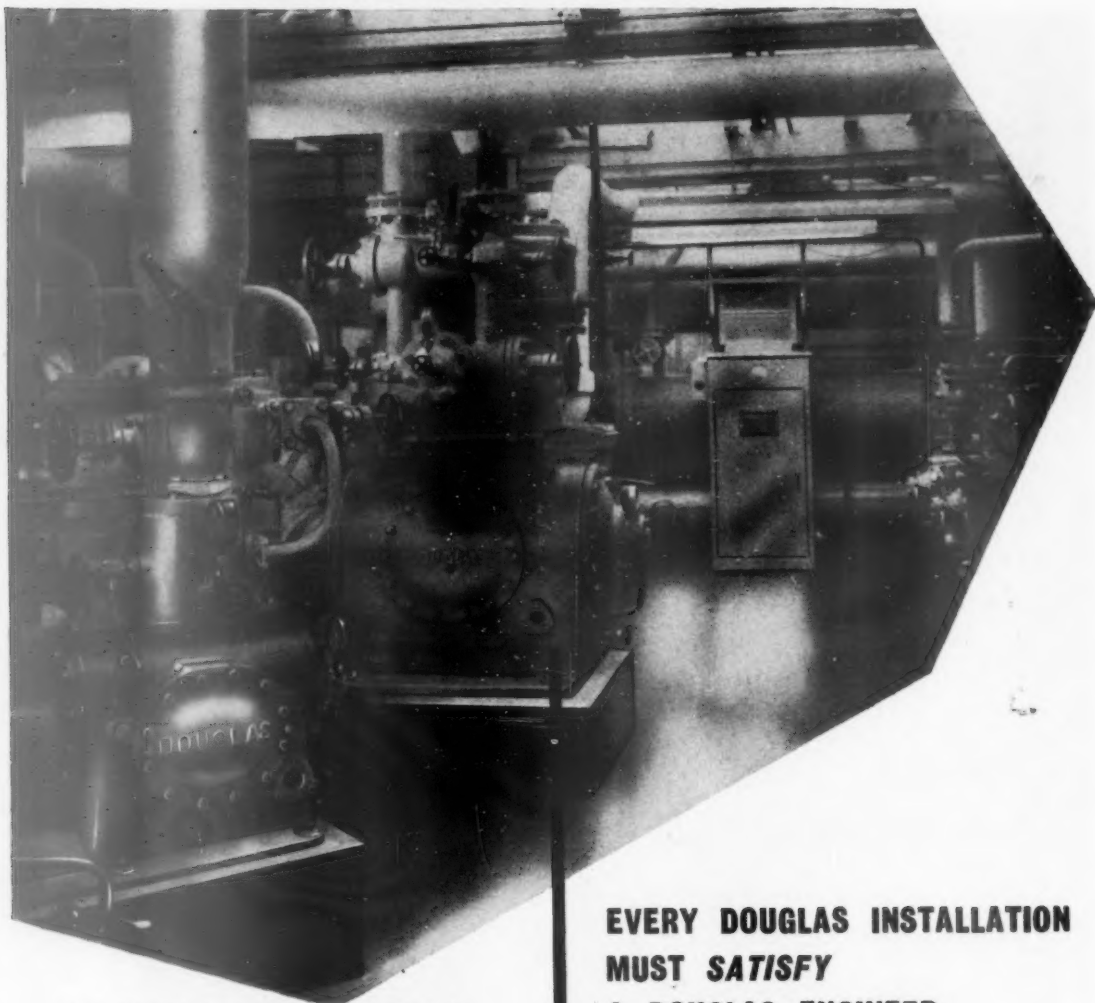


THERE IS  
A  
SEARLE-BUSH  
UNIT COOLER  
TO SUIT MOST  
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PERFORMANCE  
BY BRITAIN'S  
LARGEST  
MANUFACTURERS  
OF FINNED COILS  
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INDUSTRY

SEARLE MANUFACTURING CO LTD  
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The photograph shows two compressors out of six in a two-stage installation serving a number of ice-cream hardening tunnels. The premises are those of Messrs. Nielsons (Ice Cream & Frozen Foods) Ltd., by whose courtesy this photograph is reproduced.

**OTHER DOUGLAS EQUIPMENT COMPRISES:**

CONDENSERS shell and tube, or evaporative.  
 INTERCOOLERS  
 LIQUID AMMONIA PUMPS  
 EVAPORATORS Plain pipe, finned pipe, shell and tube, submerged type, flooded, etc.  
 INSULATION and COLD ROOM DOORS for all cold storage and low temperature applications.

# DOUGLAS

## EVERY DOUGLAS INSTALLATION MUST SATISFY A DOUGLAS ENGINEER

Reputation, not immensity, has been the foundation of Douglas growth, and every growing reputation depends upon reliability and experience. No less this one. That is why the most thorough care is taken with each installation—to ensure that everything is in perfect order.

Douglas experience, combined with personal service, is appreciated by a considerable number of users. Douglas can probably assist you. Why not think about it?

**WILLIAM DOUGLAS & SONS LIMITED, DOUGLAS WHARF, LONDON S.W.15. — Telephone: PUTney 8181**

# ZELEC

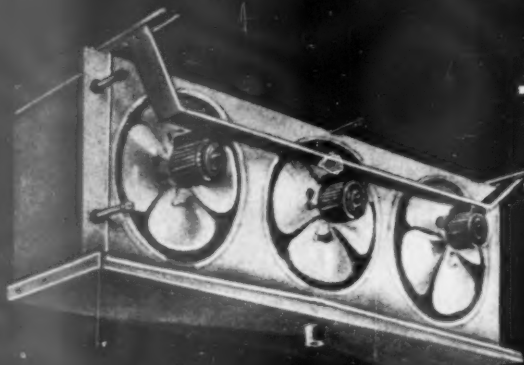
**Thermostatic**

**and Automatic**

**Expansion Valves**



## ZERO ELECTRIC LTD WALSALL



**contardo**

**Evaporators**

# ZELEC

**Sainsbury's chose**

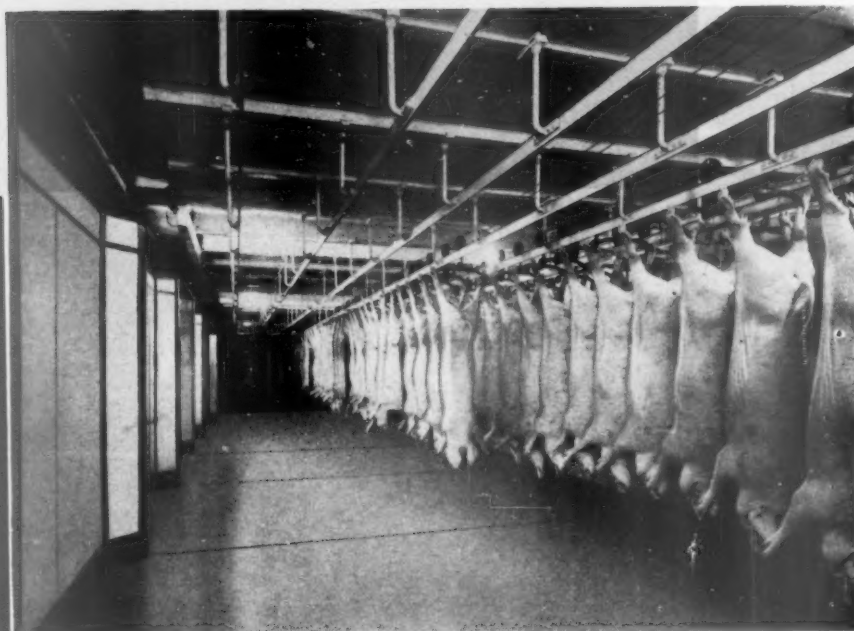
**SMITHS**

Smiths Insulations were chosen by another famous company, J. Sainsbury Ltd. to completely rebuild the Cold Store Rooms at their Haverhill, Suffolk Pig Abattoir.

Smiths Insulations were responsible for all the structural work, roofing, outer cladding, insulation, and air cooling rooms.

If you are planning a new cold store, alterations, or extensions, you would do well to call in Smiths—the specialists in low temperature insulation and cold storage.

*The interior of one of the five rebuilt cold rooms.*



*Smiths should build your new cold store*

**Smiths Insulations Ltd.**

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London Office: 105 Empire House, St. Martins-le-Grand, E.C.1. Tel: MONarch 2000

For the most compact cooling units—

see the

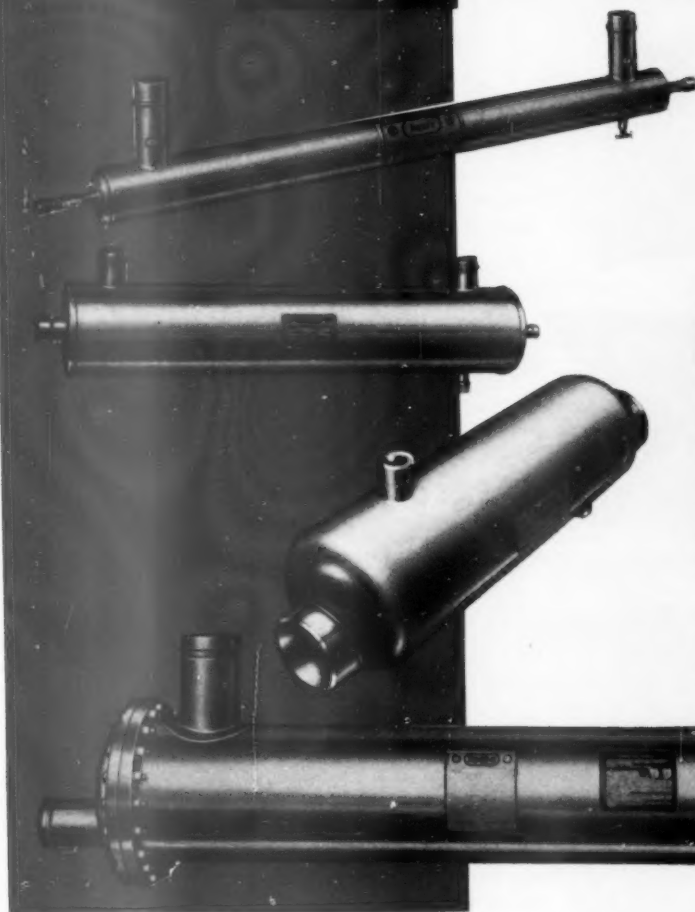
**heat-X**

**inner-fin\* range**

on

**stand 46**

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Water Chillers  
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Refrigerant Heat Exchangers  
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**HEATING AND COOLING**

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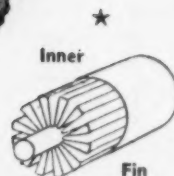
Telephone: Cosham 70161-2-3-4. Telegrams: Heatamize Portsmouth.

London Office:

**15 THE BROADWAY, WIMBLEDON, LONDON, S.W.19.**

Telephone: Wimbledon 5241-2.

Broadway #927





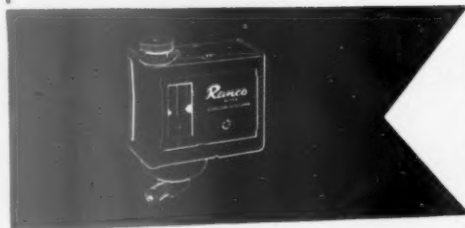
# Ranco signals S·U·C·C·E·S·S



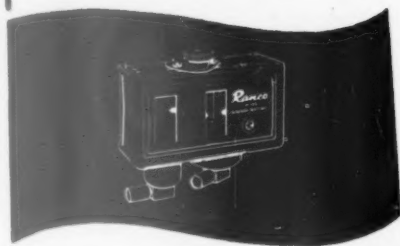
Ranco 'O' series temperature controls provide a single pole snap acting switch either closing the circuit on a rise and opening the circuit on a fall of temperature, or the reverse. The differential screw changes the CUT-OUT only on standard cooling controls: the same adjustment on standard heating controls changes the CUT-IN. Graduated visible scales indicate range and differential settings.



The Ranco 'O' series high pressure controls have been designed for commercial application. Controls can be supplied with various ranges between 100 lbs. per square inch and 350 lbs. per square inch. In all models the adjustable differential is from 30 — 100 lbs.



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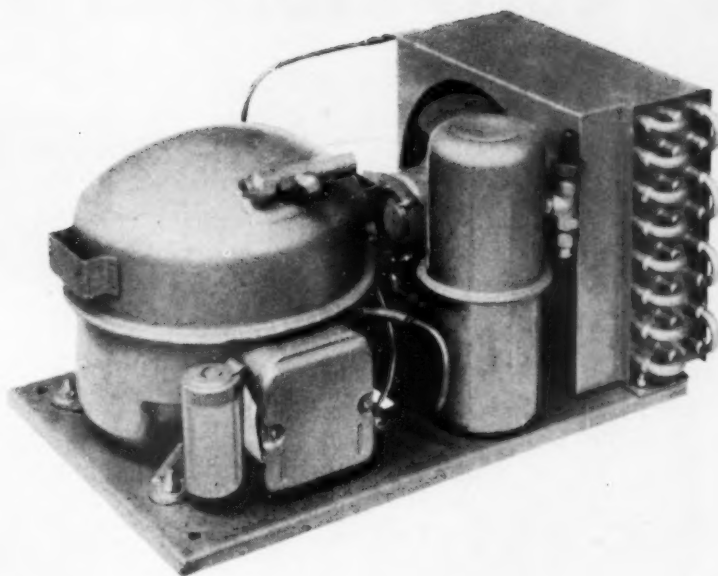
The Ranco 'O' series dual pressure controls combine the characteristics of both the low pressure control and the high pressure control in a single instrument.



For D.C. application all the above 'O' series controls are fitted with a magnet. For any further information please write to:

**Ranco Limited,**  
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*Biggest name in small controls for refrigeration heating & air conditioning*



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CAPITAL N. F. 5.000.000

Household and commercial compressors  
and condensing units 1/4 to 1 HP.  
Household and commercial systems



PERFEX 47 9

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PRODUCTS COMPANY

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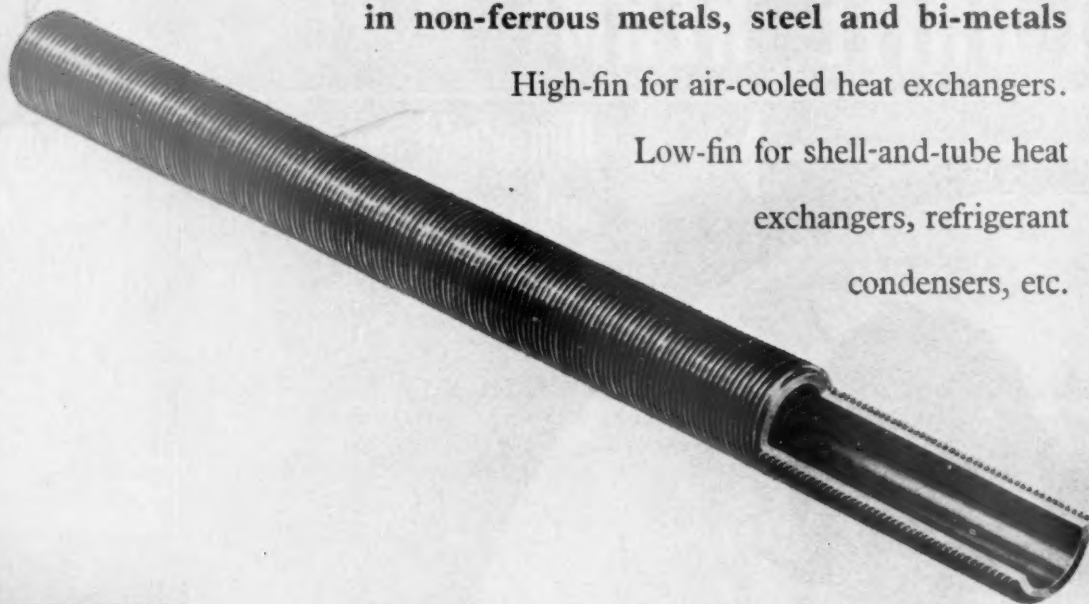
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*Integral finned  
extended surface tubing*

**in non-ferrous metals, steel and bi-metals**

High-fin for air-cooled heat exchangers.

Low-fin for shell-and-tube heat  
exchangers, refrigerant  
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**...world specialists  
in Truck  
and Trailer Units**



- **Specially designed for transport  
—not adapted from static plant.**
- **Automatic stop-and-start  
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- **One-piece, compact units.**
- **Cooling or heating at touch of  
switch.**
- **Constant body temperatures in  
any ambient atmosphere.**
- **Use least possible cargo space.**

*A full range of Thermo King units are available for all types and sizes of vehicles.  
For further information about the above and other Thermo King units, kindly write to the address below.*

HAWKER SIDDELEY (HAMBLE) LTD.  
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The pioneer run using the 'DisChIL' process was made in September, 1959. Since then many trial runs have been successfully completed covering such diverse products as scampi, poultry, sponge cakes, fish, meat and frozen foods of all types.

*The data from these trial runs is now available to you through:—*

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This service offers a means of rapidly reducing the temperature of insulated road or rail containers or of mechanically refrigerated vehicles. It can be used before or after loading and ensures that your goods travel in a bacteria free atmosphere and arrive in optimum condition.



Liquid  $\text{CO}_2$  is injected into the vehicle normally after it has been loaded. Very rapid heat extraction from the vehicle shell and contents takes place and the desired operating temperature is reached in a few minutes.

TA/3331



# Do you know about the

## **Teddington** **THINLINE**

### KCA Thermostat

Be sure to visit  
the combined TRC & HRP stand  
NO. 43, 44, & 45  
at the Commercial & Industrial  
Refrigeration Exhibition

It's the most compact, reliable and accurate refrigerator thermostat ever produced. Suitable for Absorption or Compressor type Domestic Refrigerators, the new Thinline Thermostat utilizes a well-tried seamless metallic bellows in conjunction with a heavy duty blade spring for supreme reliability. All stresses from working components are supported by a main frame of stainless metal. The switch mechanism embodies solid silver contacts especially arranged to prevent moisture accumulation between live parts. Fully corrosion resistant construction. Instruments aged under tropical conditions to ensure permanent stability anywhere in the world.

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Telephone: Sunbury-on-Thames 450

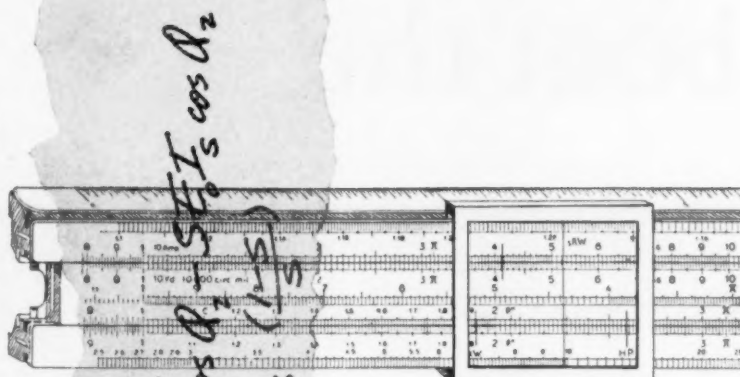
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Telex: 22742 Teddcontsunbry

#### **Branch Offices:**

31 Quay Street, Manchester. Tel: Blackfriars 2120  
225 St. Vincent Street, Glasgow. Tel: Central 3993

It takes  
more than  
a slide rule  
and data ...

The first steps in design are usually mathematical; the determination says, of the optimum of active material required for a given performance. Here the designer depends on his knowledge of the most recent work on electromagnetic theory, the potentiality of new materials and new techniques. Every designer must keep abreast of such developments. But as the design proceeds he has to make decisions of a different kind. These decisions will depend on direct experience; on knowledge obtained in practice and too complex to be reduced to a set of equations. This plays a vital part in design.



### Take, for instance, fractional horsepower motors

Take our new 'T' range in particular. The electrical design was orthodox, the calculations based on accepted principles. But in constructional design, we, like everyone else, had to rely to a considerable extent on our designers' flair—their feeling for the right job.

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LIMITED

Member of ATOMIC POWER CONSTRUCTIONS LTD.

One of the five British nuclear energy groups



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Basically the same problems are involved, problems best solved by using Spiro-Gills extended surface tubing. Our comprehensive range of gilled tubes is used in refrigeration plant all over the world. We also supply condensers, evaporators and air coolers for use with all refrigerants. We are specialists in 'specials' too. Let us know your

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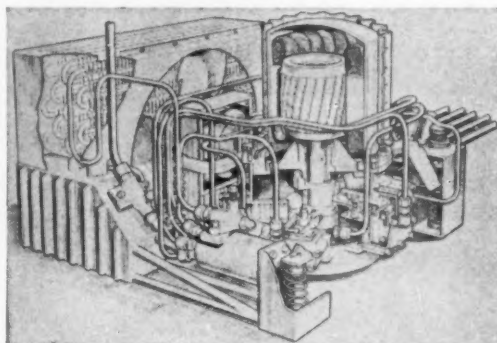
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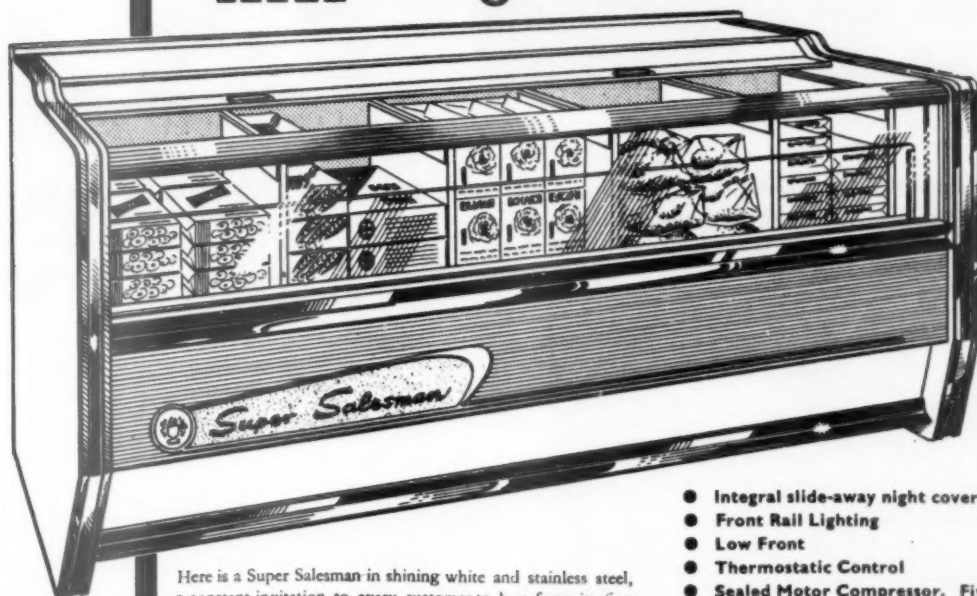
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### Looks the goods ...

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**CAPACITY:**  
(Net) 10.7 cu. ft.  
(Gross) 11.4 cu. ft.  
Price: £230.10.0  
(includes £10.10  
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months service  
fee).

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unit, but with 3  
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Capacity 7.1 cu.  
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**BOGNOR REGIS, SUSSEX.**

**RC6 Refrigerated Counter**  
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**S13 Service Cab. £111 \***



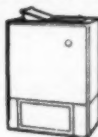
**CF 50 Conservator 12 c.f. £151.10 \***



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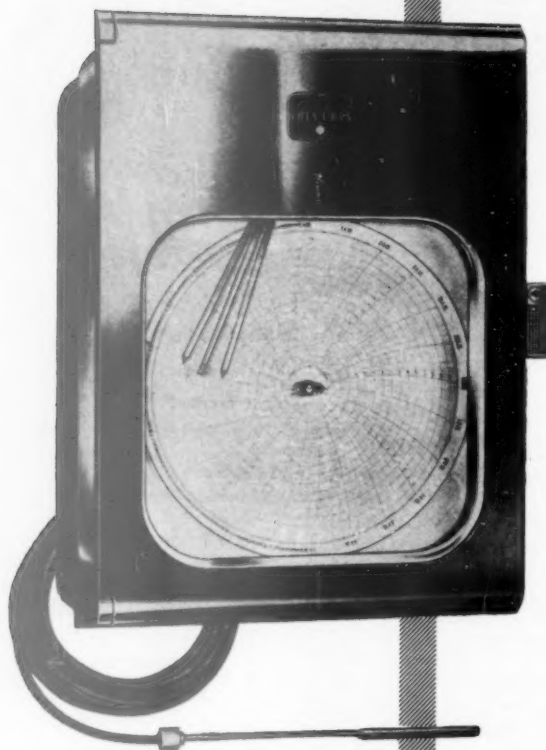
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M.R.16





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*"A blood bank refrigerator, not equipped with a constant recording thermometer, may go off during the night because of power failure. Power is restored, but not until after the blood has become warm. The blood is re-cooled and the hemolysis that occurs when the red cells are brought to body temperature at the time of transfusion may not be detected unless a sample is centrifuged. Severe hemolytic reactions may therefore result."—CARL V. MOORE, M.D., The Journal of the American Medical Association.*

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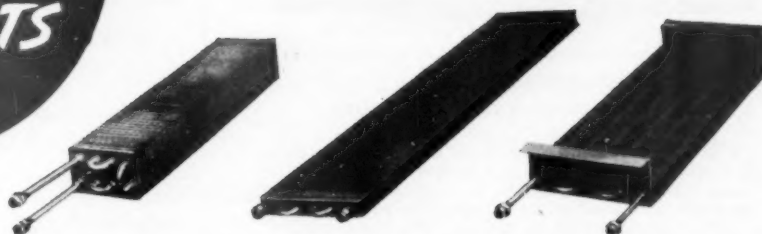
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- A WARNING OF DANGER when the temperature deviates from the safe range.
- AN ACCURATE CHECK ON TEMPERATURES by providing a continuous record of conditions in the blood bank.

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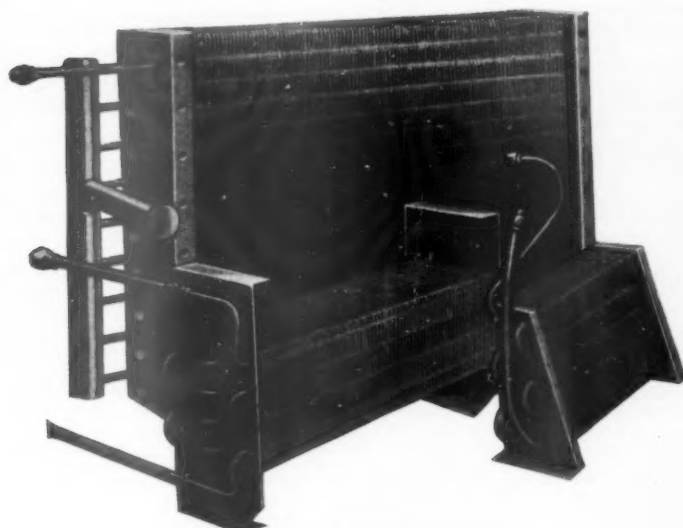


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**C**OMMERCIAL Refrigeration Sales Supervisor Vacancy exists in Frigidaire Distributorship for first class experienced Sales Supervisor to lead Sales Team in the Manchester area. Only men of approved record in this field need apply. Remuneration by way of good basic salary and generous commission. 1959 car will be provided. Assistance in removal could be arranged for the successful applicant, and fares will be paid for interviews. Applications in strictest confidence to J. H. Jones, General Sales Manager, F. W. Fidler & Son Ltd., Frigidaire House, Town Lane, Denton, Manchester. Telephone: Denton 4201. 1370

**E**XPERIENCED Sales Manager required to develop commercial and domestic refrigeration sales. Executive and technical experience necessary, together with drive and ability. Applicant with existing connections preferred. Top salary to selected applicant.—Box 1438. 1438

**E**NGINEER. Senior required by medium sized light engineering Company in the outer London area. The selected applicant will be responsible to the Managing Director. Experience of instrument quantity production and design is essential and some refrigeration experience would be an advantage. Applicants must have an engineering qualification. Age 35-40. This is a progressive position with excellent opportunities. Salary range £1,500 p.a. to £1,850 p.a. Please write giving full details of previous experience, age and present salary to Box 1457. 1457

**E**XPERIENCED Refrigeration, Service and Installing Engineers required for our depots at Brighton and Southampton. Competent in servicing all types of large equipment and domestic sealed units. Good prospects, good wages and all overtime paid. Must be able to drive and hold a clean driving licence. Apply in writing to the Service Manager, Carter & Finmore Ltd., Onslow Road, Southampton. 1458

**G**ENERAL Manager required for a large cold store in the London area. Applicants must be capable of taking complete charge. Write in confidence with full particulars of experience.—Box 1445. 1445

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Required by expanding Frigidaire distributor. Top rates paid, non-contributory pension scheme. Only first class men in either field need apply to:

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**O**FFICE MANAGER. Experienced in commercial quotations, correspondence and routine operations. Good prospects. Full responsibility.—Universal Cooler Ltd., 8, West Street, Dorking. Phone 4555. 1437

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**R**EFRIGERATION Service Engineers required by a large Company operating in Nigeria to handle domestic refrigerators and small "Freon" installations. Wide experience of this type of work essential, coupled with some experience of supervising semi and unskilled labour. Initial contract for a period of 24 months with possibility of renewal or transfer to permanent management staff. Salary approximately £1,300 per annum with free accommodation and gratuity on satisfactory completion of tour. Details of age, experience, etc., to Box 1453. 1453



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It was named a  
Design of the Year  
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## Senior Design Engineers

to join their award-winning team, designing and developing electro-mechanical domestic appliances in conditions that give unusually wide scope.

If you are a design engineer with a university degree in engineering and suitable post-graduate experience, or a Higher Certificate in Mechanical or Electrical Engineering and five to ten years' practical experience, you should study this advertisement carefully. A leading company now offers you the chance to come in at the beginning of an exceptionally rewarding project.

The entire Prestcold Division of the Pressed Steel Company is expanding and moving to a new factory in Swansea. Prestcold are now recruiting Senior Design Engineers to work at this factory, possibly after a short initial period at Oxford.

These are responsible jobs in

an outstandingly successful team. Standards are well above average. So are salaries.

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The factory itself will have the most modern production equipment in Europe. (It should have—it's only just been built!) There is

an entirely new Design and Development Building within the plant. You'll find facilities as good and as up-to-date as any in the country.

The factory is on the coast near Swansea, within easy reach of the countryside and the Gower Peninsula. The company has its own Property Department in Swansea which will be delighted to help and advise you if you're looking for a home.

If you think you measure up to the job you should write (in the strictest confidence, of course) to General Manager, Prestcold Division, Pressed Steel Company Limited, Cowley, Oxford. The interview can be in Oxford or London, as you choose.

**REQUIRED** immediately, a fully qualified Service and Installation Engineer for plants up to 10 h.p. Excellent opportunity for engineer seeking permanent post. Good pay including expenses and overtime. Modern five roomed house on new estate available for immediate occupation. All applications in strict confidence to Service Manager, Fred Hawkes (Refrigeration) Ltd., Polar Works, Coffee Tavern Lane, Rushden, Northants.

1450

**REFRIGERATION** Service Engineer required immediately. Excellent opportunity for fully qualified engineer seeking permanent position with well established distributors at good remuneration. New van provided. All applications in strict confidence giving full details of experience to James Ward (Engineers) Limited, Risca, Newport, Mon.

1449

**REFRIGERATION** Engineer, with not less than five years' experience; able to drive; sound knowledge of reciprocating units all types up to 5 h.p., and sealed unit mechanisms essential. Working knowledge of absorption principles an advantage but not essential; for progressive Sales/Service Organisation in London area. Apply in confidence to Box 1439.

1439

**REFRIGERATION** Service and installation Engineers required for East Anglia. Applications from Engineers resident in East Anglia would be particularly welcome, although all applications will be given full consideration. Permanency and security to the right applicants. Good basic salary, commission, bonus and overtime. Superannuation applies. Cottage available for one engineer. Details in first instance, in confidence to Mr. A. S. Playle, Playle of Maldon Ltd., Refrigeration Engineers, Witham, Essex.

1461

**REFRIGERATION** Service Engineers wanted, residing in East Lancashire area, and holding current driving licence. Must be fully conversant with all types of domestic and commercials up to 5 h.p. Position permanent with top rates of pay to right applicants. All replies will be treated in strict confidence. Apply Service Manager, Blue Spot Refrigeration Co. Ltd., Springfield Road, Blackpool.

1465

**REFRIGERATION ENGINEERS** required for Maintenance and Commissioning of New Industrial "Freon" Refrigeration Plant comprising American Trane, Vilter and our own manufacture. PERMANENT SALARIED POSITION. TOP SALARIES paid for a FIVE-DAY WORKING WEEK. NEW TRANSPORT SUPPLIED. In first instance apply in writing or by telephone (Teddington Lock 4406) for an interview to Alfred Porter & Co. Ltd., Stella Works, Stanley Road, Teddington, Middx.

1413

**SERVICE** and Installation Engineer required. Thorough knowledge continuous freezers, ammonia and "Freon" refrigeration.—Clarke-Built Ltd., Power Road, Chiswick, W.4.

1425

**SALESMAN.** Wanted, experienced Commercial Refrigeration Salesman for main distributors South Coast area. Must be conversant all applications. Basic salary, car provided, good commission rates. Apply Sales Manager, Carter & Finmore, Onslow Road, Southampton.

1387

**SERVICE MANAGER.** Company Manufacturing Air-conditioning and associated equipment require an experienced Service Manager to control the Refrigeration Installation and Service Department dealing in Industrial and air-conditioning applications. This department operates from the South West London area. Apply in the first instance to Box 1444.

1444

**SALES MANAGER** required by light engineering company in South London area. The responsibilities of this position include the development of sales advertising. Applicants must be over 35 years of age and have held a Senior Sales position for several years, preferably in the refrigeration industry. An engineering qualification or a sound engineering knowledge an advantage. Post offers excellent opportunities. Remuneration by salary and expenses. Write stating full particulars of previous experience, age and salary required to Box 1466.

1466

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**COLD STORE.** Complete Cold Storage Plant for disposal, including two modern 8 x 5 x 5 Halls compound, one York Compressor, Condensers, Grids, Insulation, Doors, Piping, etc. Can be inspected running in London. Compressors in new condition, one unused. Bargain for quick sale.—Box 1399.

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**ONE** MA Sterne Compressor, only used for two months, complete with S. & T. Condenser, Receiver, Oil Separator, with automatic Oil Return, Air Cooler with H.P. Floatvalve, 15 h.p. Crompton Motor with fully auto Igranic Starter.—E. J. Fox, 29, St. Johns Road, Wallasey, Cheshire.

1452

**ONE** second-hand 12 ft. Hussmann aisle model deep freeze, complete with unit and starter. Only three to four years old. One Marco Majestic complete, 12 c.ft. deep freeze, with glass front and canopy. Both cabinets are for immediate sale. Apply Seldon & Co. (Guildford) Ltd., Woodbridge Road, Guildford. Guildford 66066.

1441

## Refrigeration Compressors

Several two-stage by Hall and Sterne's, complete motors. Several 6 in. x 6 in., by Hall, Sterne's, Lightfoot; 5 in. x 5 in. Hall, York, C. & J. Weir; 4 in. x 4 in., York, Hall, Sterne's, Weir, Lightfoot, "Freon" VT7 10 h.p. and 7½ h.p., also 3, 4, 5 and 7½ h.p. "Freon" Compressors by Sterne's, York, Hall, etc. Large stockists. Keenest prices in the trade. Export orders receive special attention. Send in your enquiries. Alfred's Ices (1954) Ltd., 1-5, Hall Place, Church Street, London, W.2. Telephone: PADDINGTON 6619/6610. Telegrams: ICEFRIGO, LONDON, W.2.

830

**REFRIGERATION** Cabinets, second-hand, sizes up to and including 12½ c.ft.—Tel: MOU 3111 for appointment to view.

1364

**SECOND-HAND** Domestic Refrigerators and conservators with quantity of Compressors. One price to clear.—HARTFORD ELECTRIC CO., WATER LANE, MAIDSTONE. Tel: 2719.

1456

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1455



**T**HREE modern Ammonia Refrigerating Plants, two of 25 tons and one of five tons refrigeration respectively. Excellent condition, one plant almost new. Apply Arnold & Hancock, The Brewery, Wiveliscombe, Somerset. 1446

**Y**ORK Shipley 5 in. Twin Ammonia Compressor complete with motor, automatic starter, etc. Sterne 2M.A. 6 in. x 5 in. Twin Ammonia Compressor, complete with motor, starter, etc. Hall 4 in. Twin Ammonia Compressor complete with motor, starter, etc. All these machines in perfect running order and equal to new. Reasonable prices.—Box 1416. 1416

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**E**CONOMISER Condenser for 100 tons of refrigeration. Good condition. Please send full details to Manager, Liverpool Ice Rink, Prescot Road, Liverpool, 7. 1454

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**C**OMMERCIAL refrigeration salesman wanted to specialise in industrial field, Preston area. Excellent terms. Please do not apply for this position unless you do know refrigeration. All replies will be treated in strict confidence. Apply in the first instance to Sales Manager, Blue Spot Refrigeration Co. Ltd., Springfield Road, Blackpool. 1464

**C**OMMERCIAL Refrigeration Representative required immediately for Main Distributors. Generous basic salary and commission. London, East Anglia. Own car advantage but not essential.—Box 1435. 1435

**F**RIGIDAIRE Distributors have vacancy for SALES SUPERVISOR fully experienced in Commercial Refrigeration and capable of training and controlling a team of salesmen in the field. Car provided. Remuneration by salary, commission and bonus. Apply in writing to T. H. Wathes & Co. Ltd., 86-88, High Street, Leicester. 1443

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**R**EFRIGERATION Salesman required, Surrey. Experienced in Commercial Equipment. Generous salary and commission. Car provided. Reply giving details and experience to Hampshire Refrigeration Ltd., 37, London Road, Southampton. Prestcold Distributors. 1451

**S**ALESMEN (three) required, resident E. Riding, W. Riding and Newcastle area respectively. Exclusive agency in these territories for LEVIN display units. Wide field of products available; specialising in KELVINATOR and STERNE commercial equipment. Applicants must be fully experienced and own car, but Demonstration vehicle available in rotation. Basis of remuneration as required by applicant, scale according to proved records. Interviews Hull or York.—MASS-COLD LIMITED, 2, PRYME STREET, HULL. 1462

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having exceptional knowledge of Ship's refrigeration insulation problems and one with extensive contacts with the people who place orders for insulation installations.

The duties would entail selling a highly specialised system associated with insulation. Ample opportunity to exercise initiative.

The successful applicant would receive a generous commission in addition to a sound basic salary. After one year's service, he would be eligible to participate in the Company's Pension Scheme.

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*If you're not,  
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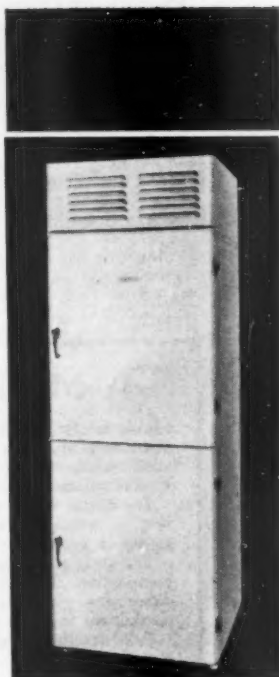
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MODEL 720 'LONG TOM'



MODEL 860 'MOBILE COLDROOM'

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*and Air Control News*



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REVIEW  
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**FEBRUARY • 1960**

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Telephone: HOP 5712      Telegrams: Buns, Souphone, London

## Editorial . . . .

### "Inst. R." Celebrates Diamond Jubilee

#### Next Cryogenic Conference

#### A Rotating Display Case

● At the Savoy Hotel, London, last month one realized how rapid had been the passing of time and that not only had The Institute of Refrigeration grown but that it had grown up—to the highly respectable age of 60. The "Inst. R." now bears the stamp of a senior learned society and is able to draw to its annual function a most distinguished body of guests who, in fact, on the 27th ultimo, attended the diamond jubilee banquet of this organization. Refrigeration touches nearly 300 industries in some way or another and this perhaps is one of its chief fascinations; the leading guests accordingly represented a wide diversity of interests.

● While all the progenitors of this flourishing institute have now passed away, there were many leaders present last month who had piloted this body through the difficult "twenties" and on to the present day. We have in mind, particularly, Lord Dudley Gordon, Mr. Kenneth Lightfoot and Mr. W. S. Douglas. These gentlemen steered steady courses for the society through the last three decades, and a great debt of gratitude is owing to them.

● Even though the engineering profession forms the nucleus of this institution, its roots are in the cold storage, ice-making and shipping industries and it is interesting to reflect that 60 years after its formation this application of refrigeration forms one of the largest outlets for the products of the industry. The membership, therefore, embraces a very important cross-section of cold store operators. In 1959, through to 1960, cold store building was still in the ascendant and it could be argued that the strength of the cold storage side of The Institute is overloaded, perhaps to the detriment of the sister organization, The National Federation of Cold Storage and Ice Trades.

● The historical aspect of cold storage was the theme of the chief guest, The Rt. Hon. The Viscount Simon, C.M.G., chairman of the Port of London Authority, who described himself as a shipowner for 30 years. He gave a brief history of refrigerated stores in London. The first had been formed at the Royal Victoria Dock in 1881, he said; it was a small underground affair and he thought it of interest to note that the machinery had been supplied by J. & E. Hall, of Dartford, whose chief was sitting next to him. Rivals soon established a similar store in the South

India Dock and for some 15 years stores were enlarged and generally developed in London. The first refrigerated store was built at Smithfield in 1896, and by 1900, the year the establishment of The Institute, there was 1,500,000 c.ft. of cold storage space in the metropolis.

● Sir Rupert De la Bère, president, revealed that the 60th anniversary banquet was the last occasion on which he would be occupying the chair of their society. He thanked all those, particularly Lord Dudley Gordon, Col. H. Randal Steward, chairman of Council, and Mr. D. T. Lee, secretary, who had so willingly helped him. He also thanked those present for their generosity in supporting the National College Fund during his term of office. The money had now been found, he said, and the building would be completed by about September.

● The 1960 Cryogenic Engineering Conference will be co-sponsored by the University of Colorado and the National Bureau of Standards and will be held in Boulder, Colorado, on August 23, 24 and 25. Papers for presentation at the conference, dealing with the technical aspects of cryogenic engineering in the field below 150° K., are now being solicited. A careful evaluation of delegate comments from the last conference has emphasized the desire for more papers covering recent fundamental work. The deadline for abstracts (not over 200 words) will be May 15, 1960. Papers at previous conferences have dealt with liquefaction cycles, purification of gases, gas separation, distillation, heat transfer, catalysis, fluid flow, absorption, hydrogen and LOX production, cryogenic fuels, oxidants, pressurants, missile problems, mechanical and thermal properties, vacuum insulation, powder insulation, super insulation, safety, friction studies, vapour-liquid equilibria, liquid level devices, probes, pumps, bearings, transfer lines, dewars, cryostats, temperature and pressure measuring devices, expansion engines and turbines, heat exchangers, regenerators, high energy and nuclear applications, bubble chambers, etc. The conference committee welcomes and encourages papers on other cryogenic subjects.

● The volume of interest already being taken in the 12th Liège International Fair, to be held this year from June 2 to 16, and the arrangements already being made, indicate that the fair will be larger and more active than ever before. The Institute of Welding will hold its annual conference at Liège and conferences will also take place on new building techniques, spectroscopy, and greater hygiene and safety in work. It is unfortunate that this important event has attracted little interest from British manufacturers in the past, and this year, because of the Common Market, what interest there was has waned into almost non-existence. It is clearly a mistake to assume that the Common Market structure acts to the complete exclusion of U.K. goods, and with the *rapprochement* between the Common Market countries and the "Outer Seven" a top priority for



1960, British firms could hardly do better than to present their goods and services at Liège, with a view to establishing them there in competition with the Common Market countries, particularly Germany. Also, one thing is certain: Belgium herself prefers to buy rather British than German, free trade or no free trade.

● Highly ingenious is the design of a new British frozen food cabinet, the aim of whose creator being twofold—to obviate the higgledy-piggledy state of contents so often encountered and to assume that the packs on display do not stay too long near the “plimsoll line.” The cabinet of 36 c.ft. capacity contains 12 trays of varying widths to accommodate different packs of frozen fish, fruits and vegetables.

A reserve storage chamber is also incorporated and this can be lifted out complete to give access to the conveyer mechanism. The revolution of the trays (which can be moved to facilitate cleaning) in the cabinet is by means of a chain drive from a geared motor. One complete revolution takes 72 seconds and a stop/start switch is mounted which can be operated if necessary by a customer. The refrigeration unit is  $\frac{1}{2}$  h.p. semi-hermetic air cooled and is fitted with a dehydrator and solenoid valve and this will easily maintain, it is claimed,  $-10^{\circ}$  F. in the cabinet. A test of weight losses through dehydration has been made comparing this Ross “Rotor” with a standard cabinet of open top type over a period of 28 days. The figures were 0-00348 oz. and 0-06952 oz., respectively.

(Picture on page 186)

## INTERNATIONAL INSTITUTE OF REFRIGERATION

### Assistant to Director Sought

The constantly increasing activity of the International Institute of Refrigeration, as shown by the many meetings of the scientific commissions and the frequency with which its advice is sought by other international organizations, has resulted in a very great volume of work for the director, Monsieur R. Thévenot.

This pressure of work has led the Executive Committee of the I.I.R. to recommend the appointment of an assistant to Monsieur Thévenot. Because the

two official languages of the Institute are French and English, it is thought desirable to appoint someone whose mother tongue is English.

The post will be permanent, with headquarters in Paris; the person appointed should have a working knowledge of French. He should have a recognized engineering qualification, with experience in some branch of refrigeration.

Anyone interested, and who would like further information, is asked to write to the secretary, U.K. Committee on the International Institute of Refrigeration, Department of Scientific and Industrial Research, Charles House, 5-11, Regent Street, London, S.W.1.

## HIGH ALTITUDE SIMULATION

Three test chambers, to be used for testing aircraft components and assemblies under environmental conditions as high as 100,000 ft. altitude with temperatures ranging from  $400^{\circ}$  to  $-100^{\circ}$  F., have been installed at the Convair Division of the General Dynamics Corporation, Fort Worth, Texas, by the Arthur E. Magher Co. Inc., of New York. The well-known B-36s were manufactured at Fort Worth and the newly installed plant will be used in the production of B-58 Hustlers, the United States' first supersonic bomber. The chambers are capable of temperature changes of from  $-85^{\circ}$  F. to  $400^{\circ}$  F. in 10 minutes and from  $70^{\circ}$  F. to  $-85^{\circ}$  F. in 30 minutes. Refrigeration equipment serving all three chambers is housed in a separate building at the plant. The three stage system uses “Freon-22” refrigerant with which methylene chloride brine can be cooled to  $-115^{\circ}$  F. The first stage compressor is a centrifugal unit direct driven by a 183 h.p. steam turbine, while the second stage centrifugal compressor is driven through step-up gears by a 483 h.p. steam turbine. The third stage compressor, a reciprocating machine, is driven by a 200 h.p. motor. The “Freon-22” gas is cooled between stages by means of liquid injection. A three-stage flash cooler sub-

cools the liquid “Freon-22” before it enters the shell-and-tube-type brine cooler. The refrigeration system is equipped with a pump-out and transfer system and also with a purge unit. The turbines use 190 psig steam and exhaust into a single surface type condenser. Worthington supplied all refrigeration equipment including compressors, turbines, and heat exchangers.

To obtain the refrigeration “fly-wheel” effect required for rapid temperature reduction of the test chambers, cold brine will be stored in a large vertical tank. This storage tank, located outdoors, will hold 150,000 lb. of methylene chloride and with the rest of the brine system, will be pressurized with nitrogen to prevent vaporization under higher temperature conditions. Remote-operated, motor-driven, gate valves will control circulation of brine to and from the tank or isolate it.

A brine pump at each chamber will maintain circulation from the brine supply main, through the coils in the “penthouse,” and back to the brine return main. Separate pumps will keep circulation in the supply and return mains. In addition, two pumps will maintain circulation through the brine cooler, one of which is for stand-by. All seven pumps are Worthington type CNR.



# NEWS OF THE MONTH

**Refrigeration and A-c Exports.**—During December 1959, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £833,405 weighing 1,369 tons, was exported from the United Kingdom. Comparable figures for December 1958 were 1,047 tons, worth £651,890.

**Exports' Analysis.**—Of the 1,369 tons of air-conditioning and refrigerating plant worth £833,405 exported by Great Britain in December—quoted in the preceding paragraph—84 tons went to the Union of South Africa, 30 tons to India, 130 tons to Australia, 27 tons to New Zealand, 26 tons to Canada, 191 tons to "other Commonwealth countries," 38 tons to Eire, 16 tons to Sweden, 354 tons to Western Germany, 29 tons to the Netherlands, 30 tons to Belgium, 30 tons to France, 38 tons to Italy, and 346 tons to "other foreign countries."

**Refrigeration Plant Classified.**—Of the total exports of air-conditioning and refrigerating machinery during December 1959, commercial refrigerators accounted for 382 tons, worth £197,491, industrial plant and equipment for 295 tons worth £147,783, and refrigerating machinery, equipment and parts, including parts of commercial refrigerators, for 335 tons, worth £247,895.

**Exports of Small Refrigerators.**—During December, 781 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £519,418. The 781 tons comprised 22 tons to the Union of South Africa, 8 tons to Rhodesia and Nyasaland, 5 tons to India, 17 tons to New Zealand, 436 tons to "other Commonwealth countries," 11 tons to Sweden, 21 tons to Western Germany, 3 tons to the Netherlands, 25 tons to Belgium, 8 tons to Italy, and 225 tons to "other foreign countries."

**New Nigerian Shopping Centre.**—The National Investment and Properties Company has begun the construction of a shopping Centre in Ibadan, capital of Western Nigeria. The estimated cost of the scheme is close on £2,000,000 and will include the need for refrigeration at many points—in the department store, in the restaurant and club and elsewhere. The developers, an entirely African enterprise, have commissioned a professional consortium to carry out the scheme consisting of: Nickson and Borys and Partners, Nigeria, and their U.K. associates, Borys, Rigby, Childs and Glover; structural engineers, Oscar Faber and Partners, chartered surveyors and valuers, Gleave and Fox; and chartered quantity surveyors, D. A. R. Rowland and Partners.

**The United States Air-Conditioning and Refrigeration Institute** will hold its 1960 Annual Meeting at the Hollywood Beach Hotel, Florida, from November 18 to 22. The Hollywood Beach session will be the first A.R.I. annual meeting since its members voted to change the Institute's fiscal year to coincide with the calendar year. Previously the meetings had been held in May. The A.R.I. board of directors will meet May 2 and 3, at the Homestead, Hot Springs, Va.

**Largest British Tanker.**—The largest British built tanker afloat, the *British Queen*, naturally has large refrigeration capacity for the storage of meat, vegetables and dairy produce required for her complement. The insulation of these refrigerated spaces was entrusted to Newalls Insulation Co. Ltd., whose long record of this class of work includes such famous names as r.m.s. *Queen Mary* and s.s. *Himalaya*.



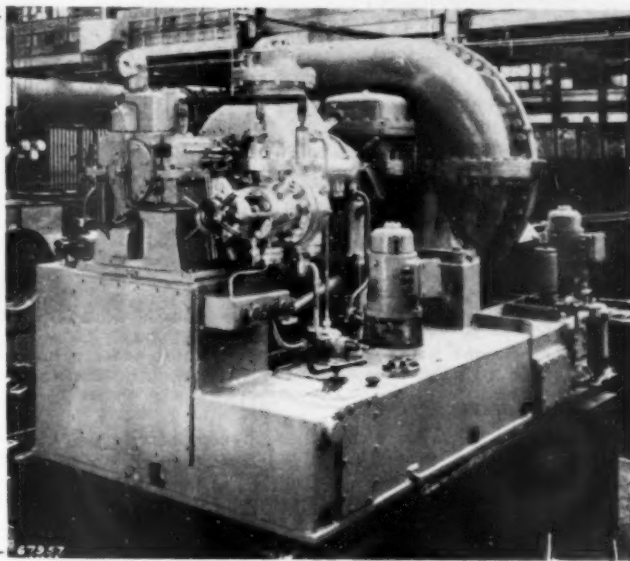
Pulling away from an Australian freighter in the London Docks with a 10-ton load of refrigerated meat is the first of the Union Cartage Company's fleet of tractors based on a Dodge 7-ton short wheelbase chassis with 351 cu. in. direct injection diesel.

The basic insulant is Newalls' Nonpareil corkboard and the finished surfaces are lined with sheet steel to ensure a high standard of hygiene. To attain the very high efficiencies required in the power raising and propulsion units of this 50,000 d.w. ton tanker, (the largest merchant vessel launched on the Clyde

for 21 years) Newalls preformed Amosite asbestos insulation was extensively employed. Over 60,000 sq. ft. of this material was in fact applied by Newalls for the boilers, turbines, auxiliaries and piping. *British Queen* has been built for B.P. Tanker Company by John Brown and Company (Clydebank) Ltd.

### MARINE REFRIGERATION

Turbo-compressor sets for the air-conditioning systems of four passenger liners have been delivered by Associated Electrical Industries (Rugby) Ltd., it is learned from their annual review of progress, to the new P. & O. liner *Canberra* and the Orient liner *Oriana*, each compressor being rated at 5,500,000 B.t.u. per hour. Two sets, each rated 4,800,000 B.t.u. per hour, were supplied for the P. & O. liner *Himalaya* and two sets, each rated 5,500,000 B.t.u. per hour, for the Orient liner *Orsova*.



### Institute of Refrigeration President for 1960-1961



Engineer-Commander W. R. Sinclair, R.A.N., B.Eng.

### The Storage of Liquid Ammonia

PERHAPS the most impressive sight at Fisons Limited's new fertilizer factory at Stanford-le-Hope is the massive liquid ammonia storage sphere, believed to be the largest insulated vessel of its type in the world and certainly the largest in this country for storage of liquid ammonia.

Viewed from a distance it dwarfs the surrounding buildings and with its silver finish presents an aspect reminiscent of some space machine—although a closer inspection reveals the twelve tubular steel supporting legs are firmly anchored to concrete bases; the possibility of it ever becoming airborne is, therefore, fortunately slight.

The 60 ft. diameter sphere is designed to store 2,000 tons of liquid ammonia at a pressure of 57 lb. per sq. in. at an approximate temperature of 0° C. In order to protect the contents from sudden temperature changes and consequent changes in pressure an efficient insulation was necessarily required and after due consideration Onazote was finally chosen, the contractors being Onazote Insulation Company Limited. This company specializes in the more critical aspects of low temperature insulation such as this present contract and the recently completed liquid methane unloading line at Canvey Island for the North Thames Gas Board which operates at -260° F.

(The refrigeration plant at Fison's will be described next month.)



The hotel is entered from the car parking forecourt under a suspended concrete canopy. The "courtesy carrier" (left foreground) is used to convey passengers to and from the various air line terminals.

# Skyway

## A NEW CONCEPT OF HOTEL OPERATION

**T**HE extent to which refrigeration is used in trade and commerce to-day is rapidly increasing, and the ways in which it can be utilized in the hotel and catering industries are graphically displayed by the new Skyway Hotel at London Airport. Owned and operated by Seaway Hotels Ltd., of Toronto, this £2-million, four-storied hotel, was officially opened in January by the Hon. George A. Drew, Q.C., High Commissioner for Canada.

No fewer than 11 pieces of refrigerated display and storage equipment, all of which were specially designed for the purpose by R. E. A. Bott (Wigmore St.)

Ltd. (Frigidaire distributors for Central London), have been installed in the kitchen, dining room and bar. In addition, three cold stores are to be found in the basement.

In the kitchen there are five refrigerated cabinets for the storage of perishable food, both before and after preparation. This equipment was designed to fit in closely with a planned kitchen system, based on American lines, and it combines storage facilities with ease of access. For example, adjacent to the dining room service door is a special refrigerated service cabinet, and the upper section of this was built with



Among the refrigeration equipment is a special cabinet in the kitchen situated by the dining room service door. This enables food to be kept chilled for immediate serving or for replenishment of the dining room display case. Gliding glass doors have been provided back and front to facilitate quick withdrawal of food by waiters together with ease of replenishment by the kitchen staff. Underneath are three extra storage lockers. Adjacent to this cabinet can be seen a low temperature case for ice cream.

sliding doors to enable the waiters to select prepared dishes for immediate service to diners.

Other outstanding features of the ultra-modern kitchen are two stainless-steel-topped cabinets, built into the preparation counters, which contain refrigerated storage lockers for holding such items as meat and poultry which are ready for preparation by the chefs. An unusual, but ideal, innovation in one of these cabinets is a series of easily removable containers, also refrigerated, in which prepared food can be stored in small quantities.

Two more pieces of equipment in the kitchen worthy of mention here are a low temperature conservator for ice cream, and a two-door service cabinet for dairy produce.

In charge of this fine array of equipment is the head chef, Mr. S. Willhoft, who has had 35 years' experience in the hotel and catering industry. Among the

kitchens where Mr. Willhoft perfected his culinary art were those of La Bella, Bombay, Hotel de Paris, Bray, and the Half Moon, Montego Bay, Jamaica.

As already mentioned, the cold stores are situated in the basement, and also below the kitchen is the pastry room. In the pastry room, a large service cabinet has been provided for the short term storage of cakes and *pâtisseries*, whilst in the cold store section three chill rooms, ranging from 310 to 850 c.ft., have been installed for holding meat, dairy and frozen food products. Attached to the meat room is a separate fish locker designed with sliding doors for easy access.

On the dining floor Brett Daniels, Ltd., Frigidaire distributors for north and west London, who installed all the refrigeration equipment, have expertly fitted the refrigeration accessories for the dining room and bar. In the dining room a large glass-fronted, case has been installed for displaying a comprehensive cold buffet under ideal conditions, and it has been so placed as to give the diners the opportunity of making a personal choice.

Next to the dining room is the long American bar, and here bottle-cooling cabinets and shelves have both been incorporated. The former have been built into the rear of the bar, whilst the bottle-cooling shelves have been installed beneath the bar counter.



Above: Specially designed cabinet with easily removable containers for the storage of prepared food.



Right: The long American bar showing, at the rear, bottle-cooling cabinets and, under the counter, bottle-cooling shelves.



# The HEAT PUMP in Large - Scale Food Processing Plant

By JOHN CROMACK

**R**ESearch into the use of packaged heat pump systems, employing direct expansion refrigeration, coupled with the development of more efficient compressors, has led to the conception of full-scale air-conditioning plants in packaged form.

A firm called Denco Miller are to install their "Thermorator" packaged air-conditioning units in the new Kunzle factory at Garretts Green, near Birmingham. The factory is scheduled to go into operation next autumn.

The space to be treated has a floor area of 26,000 sq.ft., and a capacity of 280,000 c.ft. Into this area, which will be sealed off and have insulated cavity walls, will feed the business end of cooling tunnels from a battery of enrobers, as well as output from the chocolate shell plant for cakes.

The main conditioning plant will be required to deliver 14,000 c.ft. of air a minute to maintain a room condition of 60° F. and 60 per cent. relative humidity. It will be capable of lower temperatures and humidity, if they are wanted.

Two 30 h.p. special compressors will serve the refrigeration side of the plant, using "Freon-22." At full pressure maximum consumption will be well below this. The plant will occupy a total space of 38 ft. by 5 ft.

Unique design of the compressor, which can be taken completely off-load by a hydraulic valve release mechanism, makes it possible to use a less expensive squirrel cage motor with star delta starting. The valve release mechanism has an even more important function. It enables the plant to be controlled without resort to the wasteful method of throttling the compressor suction line. A system of solenoid valves operated through an electronic circuit releases the valves progressively, as less compression is required.

Air from the area to be conditioned, plus a controlled proportion of make-up air from outside, is passed through a filter unit and on to the direct expansion evaporator for cooling. Separated from this by the eliminators which collect resultant moisture is a steam heater battery. The heated air then goes through a spray for any necessary humidification, then out into the conditioned area.

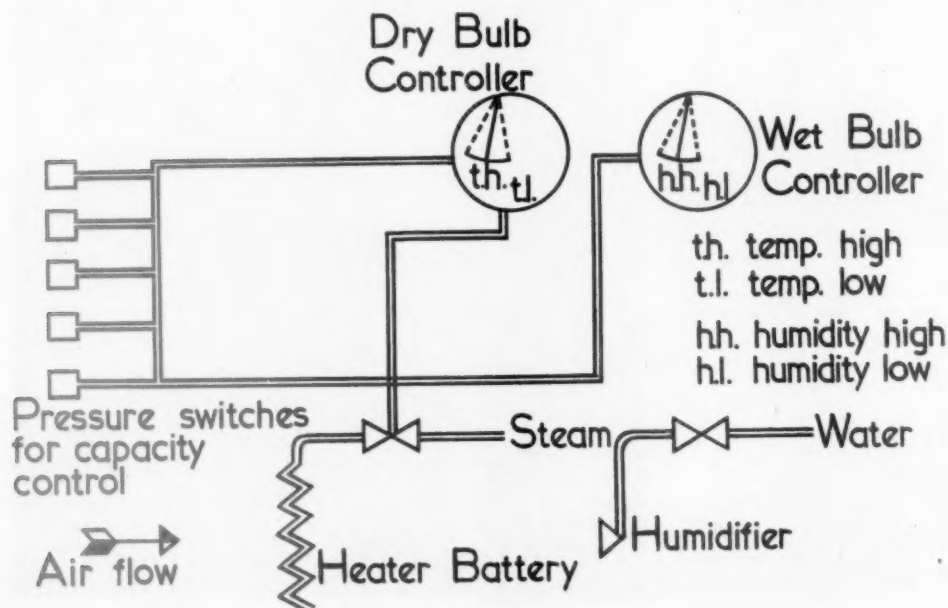
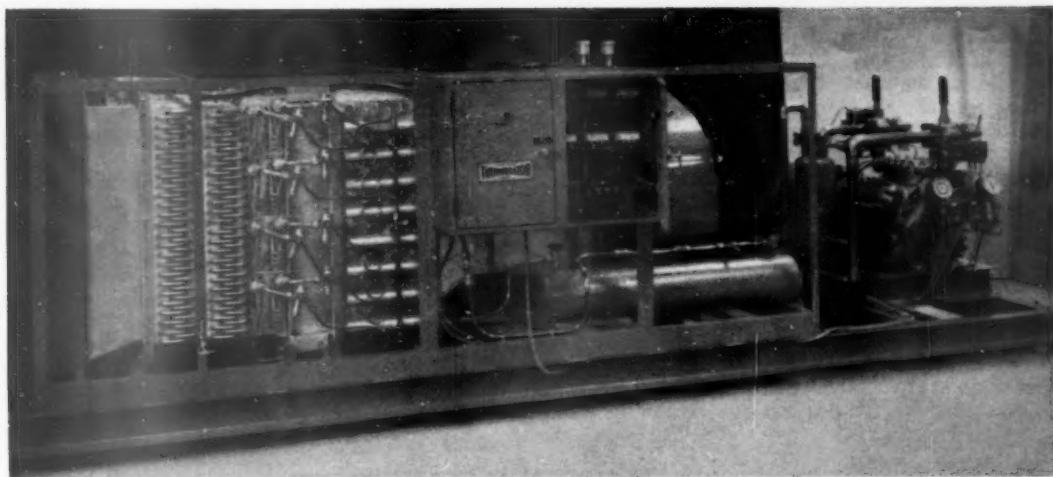


Diagram shows principle of temperature and humidity control.





The heat pump principle using condenser heat is applied in this 25 h.p. self-contained plant, with 18 tons refrigeration capacity, by Denco Miller.

Heat from the refrigerator is disposed of in a dry-surface cooler on the roof. The water feeding this cooler is drawn off, slightly warm, for various uses in the factory. It is replaced by cold mains water.

Since the plant does not make full use of the surplus heat it extracts from the air, it would not be correct to describe it as a true heat pump.

The installation can, however, be adapted to act as a heat pump by making the waste heat available for heating water for use in the factory.

The heat pump principle could have been used in another way, of course. The latent and sensible heat extracted by the evaporator could be used to reheat the air, instead of using steam batteries which have been installed for this purpose. But the plant will be mainly on a cooling load, which means that for most of the year there would be surplus heat to be disposed of. It was considered more practicable to use a conventional cooling circuit for this purpose with a potential secondary use, and to use steam for meeting the occasional reheating requirement.

With the present set-up planned for initial operation, at least no water will be wasted. And, having a dry, external surface, the cooler will not liberate any water to the atmosphere. The users cannot, therefore, be accused of contributing to fog, and there is no risk of the corrosion that occurs in industrial areas, when sulphur in the air effects a build-up of sulphuric acid in water.

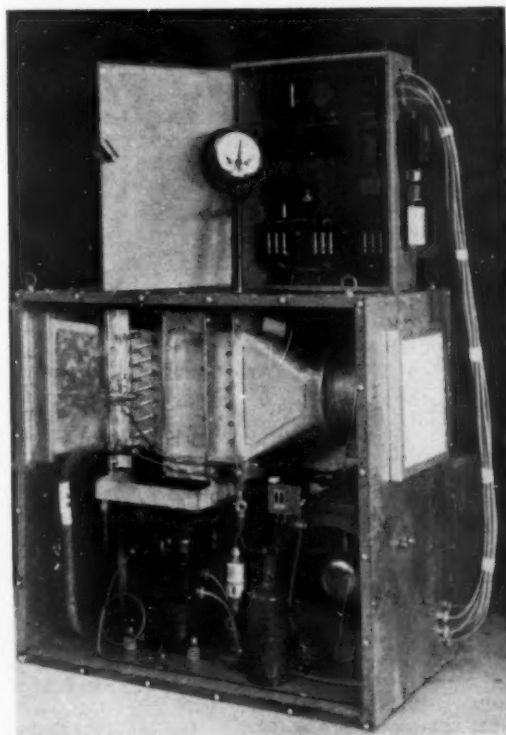
In an installation which draws all the air to be treated from outside, it is usual to saturate it through a spray before cooling to the required dew-point. This gives absolute humidity control.

But in this plant a fair proportion of the air will be returned from the conditioned area at approximately correct humidity.

At the comparatively low working temperature of 60° F., therefore, the plant is likely to be much more

concerned most of the year with removing water from the air rather than adding to it.

To saturate the air with water in these circumstances, and then have to refrigerate it out again, would be



For the stock room or warehouse. A small packaged 1½ h.p. unit for room use. It needs no ducting.

wasteful. The spray at the end of the process, which is operated by a hygrostat in the intake duct, is therefore all that is necessary.

Control over the whole system is maintained by an electronic circuit which operates solenoids, which in turn act on the release valves of the compressor cylinders according to the load required.

The electronic circuit anticipates the corrections it makes, and damps them accordingly. If the humidity rises, the wet bulb control in the conditioned area will, through the circuit, increase the compressor output, and at the same time, the dry bulb control may open the valve of the steam heater.

If the temperature rises the dry bulb thermometer will increase the compressor output.

If the temperature drops, the dry bulb control will cut down on the compressor, and open the valve of the steam heater. And if humidity drops the wet

bulb control will cut down the compressor and, if necessary, operate the humidifying spray.

This equipment can be built and tested before reaching the site of its operation. That is the advantage of the packaged plant.

Costs of installation are low and, if necessary, a unit can be moved from one part of the factory to another without major upheaval.

Direct expansion refrigeration reduces the space required for the installation, and minimizes heat losses. Also, of course, it cuts capital costs and simplifies maintenance.

Although this is a packaged system, it is tailored specially for the job. Indeed, the manufacturers do not believe in selling their equipment "off the hook"—a policy which, they feel, not only helps the user to get what he wants, but also to get what he needs.

### MANCHESTER COLD STORE TONNAGES

The following statement shows the weight of perishable goods dealt with at the Elm Street and Smithfield Cold Stores of the City of Manchester during the year ended March 31, 1959.

	Elm Street Cold Stores		Smithfield Cold Stores	
	Year ended March 31, 1959	Year ended March 31, 1958	Year ended March 31, 1959	Year ended March 31, 1958
Weight of goods received	5,850	5,626	1,849	1,719
Weight of goods delivered	5,687	5,765	1,740	1,727
Approximate weight of goods in store at March 31	567	404	161	52

Along with routine maintenance work at the two cold stores, the following special items were carried out: Portions of the roof boarding over the covered roadway at the Elm Street Cold Stores repaired; repairs carried out to the Bentley Lift, "D" Section, at the Elm Street cold stores; repairs carried out to the 200 h.p. slip ring motor at the Elm Street Cold stores; certain pipes which run along the corridor of the Smithfield Cold Stores reinsulated.

Extensive structural damage to cold storage buildings by differential movements of underlying ground have been reported in this country and elsewhere in recent years. In Canada, several cases have been brought to the attention of the Division of Building Research in Ottawa through inquiries about possible remedial measures. To meet these requests a study of the problem was undertaken by the division and it has published three papers dealing with its investigations. Copies can be obtained from the Publications Section, Division of Buildings Research, National Research Council, Ottawa, Canada.

### New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

**Gardiner Refrigeration Holdings (Western) Ltd.**, Old Bread Street, Bristol, 2. Secretary: C. J. Mahoney. To acquire all or any of the issued shares in the capital of Gardiner Refrigeration (Bristol) Ltd., Somerset Refrigeration Co. Ltd., and Arthur Brand Refrigeration Co. Ltd., etc. Directors: Edgar B. Gardiner, Oakleaze, Ridgeway, nr. Bristol; John A. Collins, Sunny Lawn, Rushton, Launton; John F. W. Compton, Austin J. Waters, Richard T. Davies and Ernest W. Harrison. Registered by Jordan & Sons Ltd.

**Gardiner Refrigeration Ltd.**, Old Bread Street, Bristol, 2. Secretary: C. J. Mahoney. Nominal capital: £100. Directors: Edgar B. Gardiner, "Oakleaze," Ridgeway, nr. Bristol; Austin J. Walters, 27, Launcester Avenue, Hanham, Bristol. Solicitors: Osborne & Co., Bristol, 1. Registered by Jordan & Sons Ltd.

**Mersey Refrigeration Co. Ltd.**, 183a, Boaler Street, Liverpool, 16. Secretary: Begona Guerrero. Nominal capital: £1,500. Directors: Henri Guerrero (permt gov. dir.) and Mrs. B. Guerrero, 37, Ivanhoe Road, Liverpool, 17; Ronald J. White, 1, Greenfield Road, Liverpool, 13. Registered by Solicitors' Law Stationery Society, Ltd.

**Evercool (Refrigeration) Ltd.**, 50, Bute Street, Salford, 5. Secretary: Edna Priestley. Nominal capital: £200. Directors: Ernest Priestley, 1, Linksway, Salford, 5; James E. Hughes, 2, Sorrell Bank, Salford, 6; Mrs. Edna Priestley and Mrs. Margaret Hughes. Registered by H. T. Woodrow & Co., Ltd.

**P. Botfish Ltd.**, 117, Cricklewood Broadway, N.W.2. Secretary: Naomi Botfish. To carry on business of heating, ventilating, air-conditioning, refrigeration and electrical engineers, etc. Nominal capital: £1,000. Directors: Philip F. Botfish and Mrs. N. Botfish, 4, Highfield Avenue, Wembley. Registered by H. Howes & Co., Ltd.

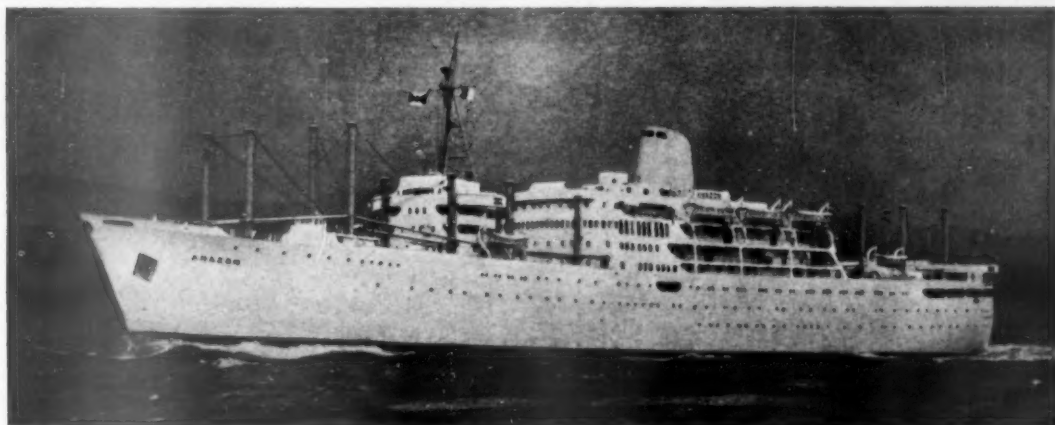
**T. & L. Refrigeration (Cardiff) Ltd.** Nominal capital: £100. Permanent directors: Malcolm E. Tennick and Keith Lloyd, addresses not stated. Subscribers: G. B. M. Williams, 36, Crystal Wood Road, Heath, Cardiff (solicitor); Q. W. P. Gribble, 630, Westbourne Road, Penarth, Glam. (solicitor). Registered by F. S. Moore, Ltd.

**R. Vickers (Refrigeration) Ltd.**, Bridge House, Nantwich, Ches. Secretary: Elizabeth Vickers. Nominal capital: £1,000. Directors: Ralph Vickers and Mrs. Elizabeth Vickers, 375, Manchester Road, Northwich, Ches. Registered by F. Taylor, Leeds.

(Continued on page 186)

# Marine Refrigeration

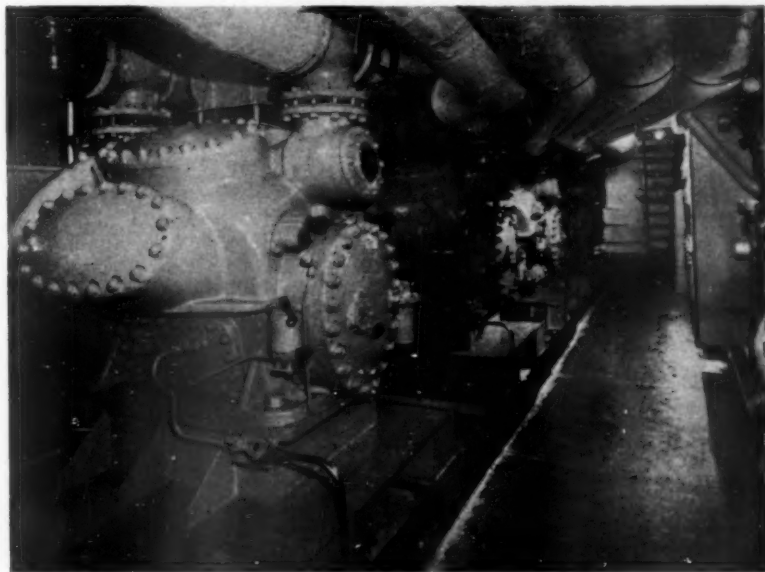
## *Four Recent Outstanding Examples of British Shipbuilding*



Royal Mail's "Amazon."

**D**ESIGNED for the South American service of Royal Mail Lines Limited, the new *R.M.S. Amazon*, which joined this company's fleet last month, has accommodation for 464 passengers comprising 107 first class, 82 cabin class and 275 third class, and the amenities include three permanent open-air swimming pools. All passenger and crew

accommodation, including the public rooms, are fully air-conditioned, and the vessel is fitted with anti-roll stabilizers. The new liner is equipped to carry about 4,200 tons of chilled meat, and a proportion of this space will be available for fruit and daily produce as seasonal demands require. Two chambers are capable of maintaining a temperature



A view of the Refrigerant-12 compressors aboard "Amazon."

of  $-5^{\circ}\text{F}$ . In addition to the *Amazon*, two sister ships are under construction at Belfast for the same owners. The first of these, the *Aragon*, is nearing completion, while the launch of the third vessel of the group, the *Arlanza*, is due to take place in the near future. *Amazon* is a twin screw diesel-engined passenger and cargo liner built under Lloyd's and Ministry of Transport survey. Her principal dimensions are:—Length overall approximately 584 ft.; length between perpendiculars 540 ft.; breadth moulded 78 ft.; depth moulded to upper deck 41 ft.; gross tonnage approximately 20,350. The vessel has been designed on modern lines with a well raked and slightly curved stem, cruiser stern, tripod signal mast and a single funnel of distinctive design. There are four complete steel decks, also lower and orlop decks forward and aft of the motor room, upper promenade, lido, bridge and observation decks. She contains three insulated cargo holds forward of the motor room with corresponding 'tween decks. Aft of the motor room, two orlop and lower 'tween deck insulated cargo spaces are provided. The insulated cargo spaces total approx. 435,000 c.ft. and, in addition, approx. 45,000 c.ft. is available for general cargo.

The refrigerating machinery installation in the *Amazon* comprises five 7-in. bore by  $5\frac{1}{2}$ -in. stroke eight-cylinder Refrigerant-12 veebloc compressors, direct coupled to 200/143 b.h.p. two-speed motors wound for 720 and 515 r.p.m.; one  $3\frac{3}{4}$ -in. bore by 3-in stroke six-cylinder Refrigerant-12 compressor, direct coupled to a two-speed 35/23 b.h.p. motor wound for 1200/900 r.p.m. and one 2-in. bore by  $1\frac{1}{2}$ -in. stroke six-cylinder Refrigerant-12 compressor driven by a 6 b.h.p. constant speed motor.

The main refrigerating machinery installation, comprising the five eight-cylinder machines, is designed to maintain the 45 insulated cargo spaces at a minimum temperature of  $15^{\circ}\text{F}$ . under tropical conditions and also to handle the  $15^{\circ}\text{F}$ . and chill temperature provision chambers, sundry cold cupboards and water coolers. In addition, the plant will handle and air-conditioning duty of approximately 5,000,000 B.t.u./hr. under peak conditions.

The refrigerating machinery installation is designed also to cool down fruit and chilled beef cargoes from their various loading temperatures to the appropriate carrying temperatures.

Brine circulation is arranged to all the principal provision chambers and all cargo spaces, a total of six 35,000 g.p.h. main brine circulating pumps for cargo, provision and air conditioning duties being installed.

All cargo spaces are arranged for air cooling, cross-grid plain pipe batteries with axial flow air circulating fans being fitted in each space. In addition, the no. 1 main 'tweendeck port and starboard chambers are fitted with brine cooling grids to permit the carriage of low temperature cargoes down to temperatures of  $-5^{\circ}\text{F}$ .

In addition to the nine brine cooled provision chambers referred to above, two rooms are designed

for the carriage of quick-frozen foods and these chambers are handled by the 6CP 2 in. by  $1\frac{1}{4}$  in. veebloc compressor.

The low temperature chamber plant is arranged for direct expansion operation and bulkhead mounting air coolers are fitted in each chamber. The six-cylinder  $3\frac{3}{4}$  in. by 3 in. veebloc compressor installed in the main engine room is intended to perform the main provision chamber holding duty when the vessel is in United Kingdom port or temperate waters, to avoid the necessity for frequent starting and stopping of the main compressors. This machine is arranged for automatic control.

It should be noted that the main compressors, in addition to being direct coupled to two-speed motors, have capacity reduction gear fitted to six of the eight-cylinders, which offers a very wide degree of flexibility from the operational viewpoint.

In service on the homeward voyage the refrigerating machinery installation will be required to perform a wide range of duties, ranging from maintaining spaces at  $15^{\circ}\text{F}$ . for frozen cargo,  $28^{\circ}$  to  $30^{\circ}\text{F}$ . for chilled beef and to cool citrus fruits and bananas loaded on the Brazilian coast as well as performing the air-conditioning duty referred to above.

To cater for these varying duties the brine system is designed for simultaneous circulation of five independent brine temperatures, namely, freezing, first chilled beef, second chill and fruit, air-conditioning and high chill and thaw. Provision is made for fine control of the chill temperature brine mains by arranging injection leads from the freezing temperature.

The vessel also incorporates the first large scale installation of automatic temperature control equipment for the brine injections and the cargo spaces, the equipment comprising air-operated temperature controllers of Drayton Regulator & Instrument Co. Ltd.'s "Dial-Set" pattern with diaphragm type brine control valves. The main air supply for the installation is taken from the vessel's starting air cylinders and reduced to a normal working pressure in the forward and aft air leads of approximately 100 lb. per sq. in.

The sensitive elements of the cargo space temperature controllers are fitted in the delivery air stream of each of the chilled beef spaces and connected to individual temperature controllers arranged in the cooler access space. Compressed air piping is led from the temperature controller to a modulating brine control valve arranged in the return main from the appropriate air cooling batteries.

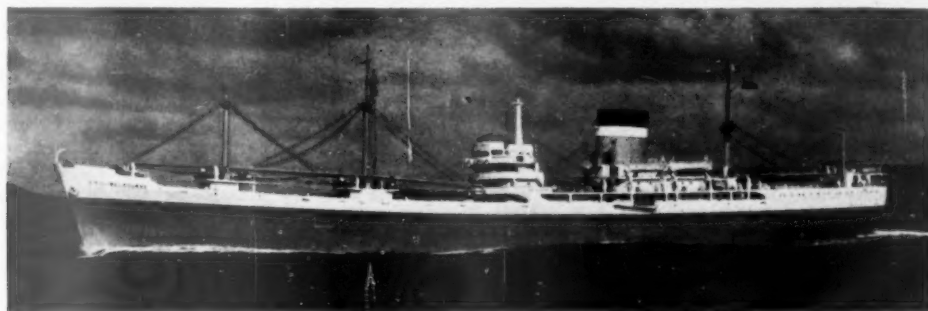
In the case of the injection control valves, the sensitive elements are installed in the controlled brine delivery mains and connected through the temperature controller to modulating injection control valves.

The refrigerating machinery installation incorporates electric motors and controllers by Mather & Platt and Electrical Apparatus Co., respectively. The main brine and sea water circulating pumps are of Drysdale manufacture, electric distant reading thermometers and  $\text{CO}_2$  sampling equipment of



Elliott Bros. (London) Ltd. manufacture. Cargo space and provision chamber fans are of Axia Fans Ltd. make. The air refreshing arrangements for the insulated cargo incorporate Duplex centrifugal fans manufactured by Keith Blackman Ltd.

A FINE example of modern design in refrigerated cargo vessels is the new single-screw, motor ship *City of Melbourne* delivered to Ellerman Lines Ltd. in 1959. This vessel has been built by Alexander Stephen & Sons Ltd., at Linthouse and specially designed for service between the United Kingdom, Canada and Australia.



Ellerman's "City of Melbourne."

*City of Melbourne*, is constructed as a complete superstructure vessel and is powered by a 12-cylinder supercharged Sulzer diesel engine and has a service speed of 17 knots. The principal particulars are as follows:—

Length overall	...	545 ft.
Length between b.p.	...	510 ft.
Breadth mld.	...	71 ft.
Depth to 2nd deck	...	33 ft. 6 in.
Draft	...	28 ft. 9½ in.
Deadweight	...	12,300 tons
Gross tonnage	...	9,920 tons
Cargo capacity, bale	...	560,670 tons
Cargo capacity, refrigerated	...	164,260 tons

Externally the vessel is of graceful appearance with a raked stem, neat cruiser stern and fitted with three raked masts giving a trim appearance to the superstructure which has been arranged aft of midship to suit the position of the machinery. The vessel is built to Lloyd's Class +100A1 with refrigeration and has five main cargo holds with corresponding lower and upper 'tween decks.

No. 2 lower and no. 3 upper and lower 'tween decks and no. 4 hold are insulated for the carriage of frozen or fruit cargo. No. 2 lower and no. 3 upper 'tween deck are also arranged for chilled cargoes.

The refrigerating plant to deal with the cooling of no. 2 lower 'tween deck, no. 3 lower and upper 'tween decks and no. 4 hold—10 compartments in all—has been supplied by J. & E. Hall Ltd. All the

refrigerated cargo spaces are suitable for the carriage of frozen cargoes or fruit, no. 3 upper 'tween deck being also fitted out for carriage of chilled beef and no. 2 lower 'tween deck for the future carriage of chilled beef. A system of CO<sub>2</sub> injection has been installed for the chilled meat spaces.

The refrigeration plant consists of three eight-cylinder Veebloc compressors using Refrigerant-12, direct coupled to 97 b.h.p. electric motors, three shell and tube type condensers and three shell and tube type evaporators. This plant is situated on the second deck, starboard, abreast the main engine casing together with the brine room and refrigeration spare gear store.

Air is circulated by reversible fans of the axial

flow type supplied by Axia Fans Ltd. A system of electrical distance-reading thermometers, working on the three wire "null" point system, has been supplied by Elliott Bros. (London) Ltd. while nine ozone portable generating sets have been supplied by E.C.D. Ltd.

Refrigerating plant for the provision chambers has also been supplied by J. & E. Hall Ltd.

A system of thermal injection has been supplied by Thermotank Ltd. to eliminate sweating at the boundaries of the insulated spaces.

The insulation of the chambers is of Rocksil held in place by resin bonded plywood supplied and fitted by the Cork Insulation & Asbestos Co. Ltd. An interesting feature is that the insulated cargo doors, cooler access doors and provision chamber doors are of reinforced polyester resin with polyurethane foam filling in lieu of the normal teak and Rocksil. The insulation medium on the MacGregor hatch covers to no. 4 insulated hold is also, polyurethane foam. All the cargo spaces, including those insulated, also the engine room, are protected against fire by "Kidde-Rich" combined detecting and extinguishing CO<sub>2</sub> system. This system is of the automatic type incorporating two visual smoke detector cabinets, one situated adjacent to the CO<sub>2</sub> cylinder room and a single point cabinet is fitted in the wheelhouse.

Air-conditioning is fitted in the dining saloon, duty mess, smokeroom and European hospital in this worthy addition to the Ellerman fleet.



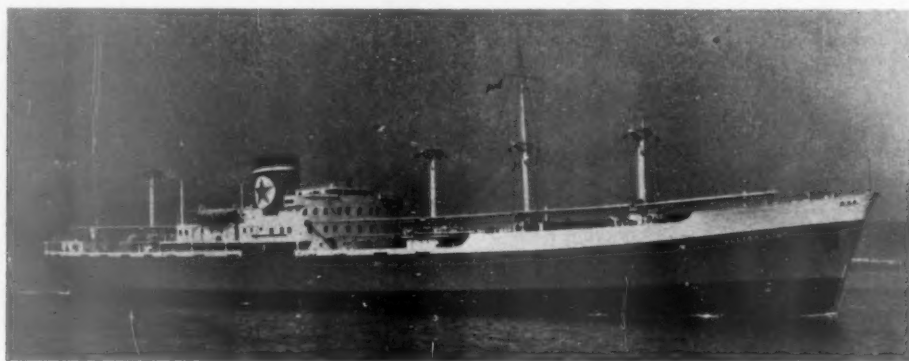


Houlder's "Royston Grange."

The fourth Houlder Line vessel to bear the name *Royston Grange* came into that company's service in December last. Designed for the River Plate service of the owners, *Royston Grange* will transport chilled and frozen meat and other perishable cargoes. A dozen passengers can be accommodated on the bridge deck. Of 10,050 gross tons, this turbine-driven steamship has refrigerated cargo capacity of 439,000 c.ft. Six cargo holds are provided, four

forward and two aft of the machinery space. Each cargo hold and 'tween deck is divided into three insulated compartments cooled by air circulation. The refrigerating machinery was supplied by J. & E. Hall Ltd. while the insulation work was carried out by The Mersey Insulation Company using polyurethane foam and fibre glass as the insulants.

Ozone-making apparatus by E.C.D. Ltd. is installed in the cargo spaces for use after carrying fruit cargoes.



Blue Star's "Ulster Star."

The Blue Star Line's *Ulster Star*, which was brought into service last year, is a fine example of this company's type of fast cargo vessel capable of accommodating also six passengers. Of 10,413 gross tons (11,000 deadweight tons) she has dimen-

sions of 490 ft. length overall, 70 ft. beam and 38 ft. draught. *Ulster Star* is able to provide 450,000 c.ft. of refrigerated space for the carriage of perishable foodstuffs from overseas. Her refrigerated provisions storage areas measure 2,500 c.ft.

**Australian Opportunities.**—Production of refrigerating appliances and parts in Australia is a potential opportunity for British manufacturers, according to a survey of investment opportunities in Victoria, prepared for the Victoria Promotion Committee. The survey, made by the Stanford Research Institute

of California, points out that over £785,000 worth of such parts were imported during 1958-9, mostly special controls and valves. Some of these, says the survey, could doubtless be made in Australia in conjunction with the refrigeration and air-conditioning industries.

# Optimum Conditions for Fresh Food Preservation in the Domestic Refrigerator

By E. W. Zearfoss  
and F. P. Speicher

A short extract from this paper, given in our November 1959 issue, has created widespread interest; we are, therefore, publishing here further portions of the text.

**S**TUDIES of fresh food preservation have been published both from the standpoint of food technology and from the standpoint of refrigerator design. These areas of activity differ; the food technologist explores preservation factors while the design engineer studies related functional embodiments.

The science of food technology applies recognized methods of evaluating microbial growth and chemical changes as a function of temperature and humidity. These tests are controlled and measured by techniques appropriate only to the laboratory. Present studies indicate the existence of a temperature and humidity focal point for optimum food storage.

Design engineering, on the other hand, involves an end product—the domestic refrigerator. Collectively, refrigerators exhibit a wide temperature and humidity spectrum and a variety of basic design features. Engineering-wise, a given design can be evaluated only in the light of existing standards.

## Food Technology

To perform its major function, the domestic refrigerator should provide optimum storage conditions for the extended preservation of a variety of perishable foods. These foods include such diverse groups as fresh meats, vegetables, fruits, dairy products and leftovers.

In defining optimum storage conditions, it is important to distinguish between conditions desirable for ripening, ageing and maturing after harvest or production, and those which subsequently are best for preserving or keeping the foods from deterioration. Also, it should be recognized that fresh foods may have a questionable history when marketed to the home-maker, and perhaps are rapidly losing their quality and approaching the end of their edible life. In any event, the optimum conditions for fresh food preservation in the household refrigerator are those which affect maximum edible life of the stored food-stuffs commensurate with their market day quality.

To extend the storage life of a food, the chemical and microbial changes responsible for deterioration must be retarded. These changes are minimized by low temperatures. To illustrate the relationship between microbial growth rate and refrigeration temperatures, petri dishes filled with sterile nutrient agar were streaked with species of food-destroying micro-organisms and incubated in both saturated (100 per

cent. r.h.) and dry (40 per cent. r.h.) air at temperatures of 45°, 39° and 33° F. respectively, for seven days. The micro-organisms used were (1) a mixed culture of bacteria which had been isolated from spoiled refrigerated beef (2) a pure culture of bacteria from spoiled peas, and (3) a mould isolated from fresh vegetables. Photographs of the dishes were taken on the third, fifth and seventh days of incubation.

These data show that reducing the refrigeration temperatures to the near-freezing point results in a significant decrease in microbial growth, and indicate that fresh foods stored at this temperature would exhibit minimum microbial spoilage. The identical growth rates of the bacteria at 40 and 100 per cent. r.h. when incubated at the same temperature show that temperature is the dominating factor. This suggests that one shortcoming usually associated with high humidity, the sliming of meats, can be curtailed effectively by near-freezing temperatures.

Another benefit of lower temperatures is the slowing down of the natural chemical changes which result in browning, softening, etc., of many fresh foods. This is well substantiated by research reports from many food laboratories which reveal that meats and most fruits and vegetables keep better and longer at near-freezing temperatures.

Equally important in the degradation of refrigerated foods is desiccation. The problem of foods drying and shrivelling has been recognized for some time by the home-maker and is a common source for complaints about the household refrigerator.

The rate at which a specific food will lose moisture depends on its surface characteristics and on the temperature, humidity and movement of the ambient air. To show the effects of these factors, the dehydration rate of freshly opened peas was determined at various relative humidities and temperatures in still air using the following procedure.

The desired relative humidity was maintained in a 4-in. by 8-in. by 11-in. sealed plastics container by means of a solution of water and glycerine. Items placed in the chamber were set on a metal trivet above the surface of the solution. A thermocouple and an electric hygrometer sensing element were attached to the inner surface of the lid. Four such chambers containing glycerine-water solutions calculated to give relative humidities of 100, 80, 60 and 40 per cent., respectively, were placed in a constant temperature refrigerated cabinet. A petri dish containing approxi-

mately 50 grammes of prechilled canned peas was weighed and placed in each chamber. After three days the dishes were again weighed and the weight loss per 24 hours was computed for each dish. Tests were conducted in this manner at temperatures of 45°, 39° and 33° F. Results of these tests show the recognized relationship between evaporation rate, temperature and relative humidity.

To simulate the effects of natural convection currents in a conventional refrigerator, a small 600-r.p.m. fan with a 2-in.-diam. blade was mounted directly above the peas with the motor external to the chamber. The 24-hour weight loss was determined for various relative humidities at 33° F. These data are compared with 33° F. still air evaporation rates. The curves (not shown) illustrate the considerable increase in evaporation rate caused by a relatively small air movement.

It should be noted that the rate at which a specific food item loses moisture to the atmosphere also depends upon its exposed surface area and the nature of its surface. Thus, various foods show different weight losses per 24 hours under the same conditions. Canned peas were selected for these tests for reasons of convenience and repeatability.

Based on the results of these studies and related reports it may be presumed that the optimum storage conditions for preservation of most foods in the household refrigerator are at the focal point of a near-freezing temperature, high humidity and still air.

### Design Engineering

The engineering achievement of the optimum environment derived in the foregoing discussion of food technology can now be described.

When the surface of a hollow geometrical configuration exists at a uniform temperature, the enclosed volume will reflect this temperature. Further, moist foodstuffs within this volume will produce a saturated vapour-air mixture. Any subsequent temperature depression on a given boundary area causes water vapour to condense from the mixture thereby decreasing the original vapour pressure and humidity. Correspondingly, the vapour pressure differential effected between foodstuffs and the unsaturated air comprises the mechanism for food desiccation or dehydration. Dehydration rate depends upon the magnitude of the area and temperature deviations noted above. Further, food dehydration will occur when the compartment is not vapour-tight. Basically, these parameters define the engineering problems involved in producing and controlling a saturated vapour-air mixture in a compartmented sector of a refrigerator.

Refrigerators have been compartmented for many years. Sometimes the compartment did little more than provide convenient storage for one kind or group of foodstuffs. Individual compartments have thus accommodated vegetables, fruits, meats and dairy products. In some instances the design temperature or humidity was expressed and advertised in such relative terms as high humidity or low temperature.

Compartment designations or trade names frequently included an environmental connotation to support this theme. In any case, these compartments for the most part had various psychrometric properties.

Although there is now a trend toward marketing features which emphasize food preservation, no domestic refrigerator to-day has a single compartment designed to combine and store adequately the diverse groups of foodstuffs that benefit from controlled temperature and humidity. However, the optimum conditions for a wide variety of foods described earlier in this paper suggests a new philosophy for modern design.

Contemporary engineering trends and developments in domestic refrigerators co-operate to allow this objective to be realized. In one embodiment which achieves this objective, a vapour-sealed compartment having a separate closure is provided within the cabinet liner. Cabinet air is drawn into a duct system over an evaporator. The refrigerated air is then divided; one part is discharged to the upper regions of the cabinet, while the second part flows downward through the duct toward the lower portion of the cabinet. Thus, four vertical walls of the sealed compartment are literally wrapped in cold air. When an insulated freezer section is located below the fresh-food compartment, passage of air beneath the compartment is optional. The air system, powered by a small motor and blower assembly, has a thermostatic control. Dimension-wise the compartment readily accommodates assorted vegetables, fruits, cold cuts, meats, leftovers, etc., all stored uncovered. The functional organization of the compartment can be adapted to individual preferences.

The compartment, sealed to perform at saturated humidity, must be cooled on its boundary surfaces. Since gradients in surface temperature reduce the relative humidity, the boundary temperature must be as uniform as good design can achieve. Thermally conductive materials, especially in the compartment vertical wall sections, help to achieve this objective.

A forced convection system will allow a higher rate of air circulation than a gravity system, and a correspondingly decreased temperature differential measure around the complete air circuit. This minimizes compartment surface temperature gradients and affords a marked improvement in over-all design. In using forced air the location of the compartment within the cabinet might appear flexible to the whims of utility and styling. However, the lower section presents definite advantages since air stratification allows cabinet regions above the sealed volume to be controlled at a temperature higher than that of the compartment. This warmer zone is important for several reasons yet to be noted.

The advantages of forced convection to the design of a low temperature, high humidity compartment are :—

(1) Following cabinet usage, forced convection provides quick recovery to the optimum temperature.

(concluded on page 167)

# New Cold Store in East London

## Former Ice-Making Premises Converted into Modern Plant

IN June 1958, United Carlo Gatti, Stevenson and Slaters Ltd., 35, Parkgate Road, London, S.W.11, brought into commission at their Battersea premises a new cold store which incorporated a number of interesting features. Another store on the same lines, of 250,000 c.ft. capacity, is in the course of construction at 120, Queensbridge Road, Hackney, London, E.2. The general principles of design and installation used at Battersea, which included complete envelope construction and insulation throughout with Jablite expanded polystyrene, proved so successful that they are being incorporated in the new store. The main difference will be that the general floor thickness at Hackney, and the quantity of massed concrete will be greatly increased to allow for economy in general operation and to allow substantially greater loading.

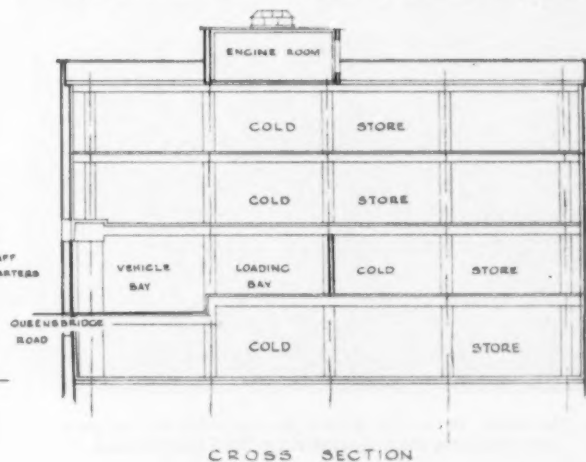
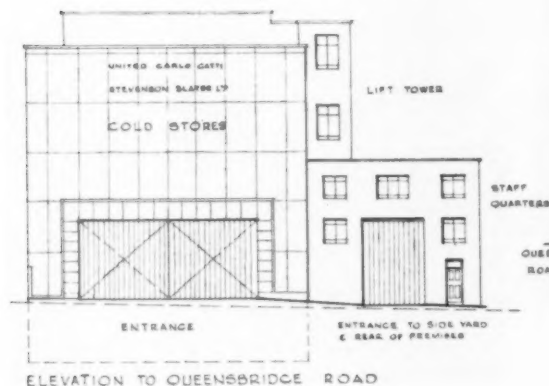
The new store is being erected on the site of one of the company's old ice factories and preparatory work has involved considerable demolition and excavation. The original factory had an internal reinforced concrete structure, probably one of the first of its kind in England, and demolition work has involved the removal of over 25,000 c.ft. of concrete and supporting brickwork. To replace the internal structure the contractors, T. W. Weeks & Co. Ltd., are using a new and modern construction consisting of 24 massed concrete piles. A number of these are designed to take a load of 520 tons per pile and the store will be so erected that strength of

the building will be in the interior and will be formed solid throughout in reinforced concrete. The total weight in the new internal concrete structure will be 3,250 tons.

Around the internal structure and including the basement will be a complete insulated envelope, and contrary to normal practice, the intervening floors will be insulated (sandwich construction) on the top side instead of the soffits. This method is in fact "floor heating in reverse" and the presence of this refrigerated mass of concrete within the insulated envelope will assist in maintaining set temperatures and provide a large hold-over factor and reserve of refrigeration against shock loads as well as greater economy in running the plant. This feature allows for greater flexibility when dealing with maximum demand charges and restricted power load periods.

The finished store, which will consist of four large chambers including the basement, will incorporate an extensive loading bank with a large covered drive-in for vehicles which will be housed within the existing building. The engine room will be sited on the flat roof 45 ft. above ground level.

Refrigeration is being installed by L. Sterne & Co. Ltd., and will comprise three-3 MAC compound compressors and two forced draught condensers connecting to grid coils and battery coolers in the various chambers. The temperature range will be from  $-20^{\circ}\text{F}$ . to  $16^{\circ}\text{F}$ . and each chamber will be able to run at a selected temperature.



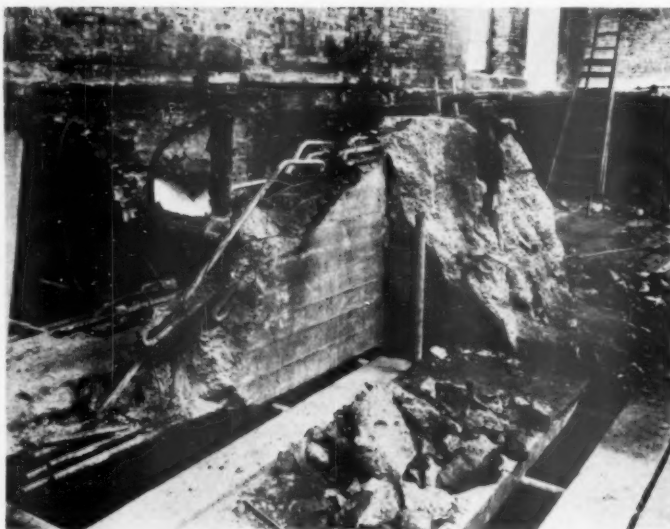


The whole store, including the basement, will be served by high speed lifts.

Construction and insulation are in the hands of T. W. Weeks & Co. Ltd., and the architects for the new store, which will be completed towards the end of this year, are Haynes & Carpenter, who also designed the Battersea store.



Part of the interior and the first stages of demolition. It gives some idea of the massive 4 ft. 6 in. by 1 ft. 3 in. reinforced beams which had to be broken out.



This illustration shows the gutted interior with the entrance to the cold store from Queensbridge Road now formed.



Building as it was when originally an ice factory. Demolition of interior had just commenced when this photograph was taken.







1

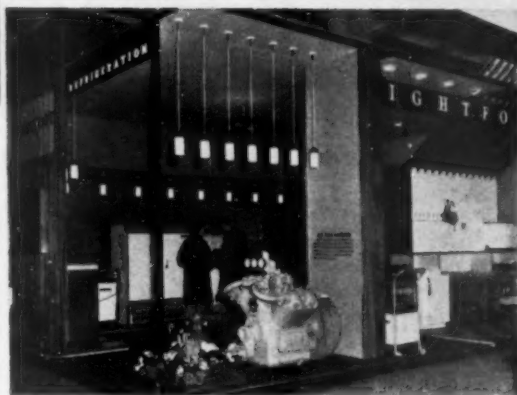


3



5

## Refrigeration Exhibits at Hotelympia



2



4

1. Pressed Steel Co. Ltd., Prestcold Division.
2. The Lightfoot Refrigeration Co. Ltd.
3. York Shipley Ltd.
4. Frigidaire Division of General Motors Ltd.
5. Smethurst's.

# REFRIGERATION

## in a Food Factory



THE new Heinz factory at Kitt Green, near Wigan, opened by the Rt. Hon. Viscount Kilmuir, G.C.V.O., early last year, is the largest food factory in the British Commonwealth and has cost £7,000,000.

The Kitt Green building is a fine example of contemporary architecture and embodies many new forms of construction and the most up-to-date methods of factory planning and equipment. It consists, basically, of a storage building surrounded by a brick wall, in which 2,000,000 bricks are used, adjoining a manufacturing building surrounded by a glass curtain wall 46 ft. high and 1,080 ft. long, the largest wall of its type in Britain.

The refrigeration equipment by J. & E. Hall Ltd., at Kitt Green, comprises four stores with a total

capacity of approximately 80,000 c.ft. Largest of these is the pre-frozen meat store, which is kept at 10° F. by two six cylinder veebloc compressors operating unit type air coolers. A similar compressor and two coolers are used in the vegetable cold store, with a condenser of the shell and tube multipass type. The meat and vegetable store is cooled by a compressor of the same size, whilst for the smallest of the four stores, also used for meat, a six cylinder veebloc compressor and single unit type air cooler are used.

*Store No. 1*—This cold store is maintained at a temperature of 10° F. and is used for the storage of pre-frozen meat. It is 53 ft. long × 46 ft. wide giving a capacity of 29,250 c. ft. For this duty two 3½ in. × 3 in. six cylinder veebloc compressors are used, each driven by 15 h.p. electric motors. Two unit type air coolers are used in the store fitted with water defrosting equipment.

*Store No. 2*—This is used for the storage of vegetables and is maintained at a temperature of 32° to 35° F. The internal dimensions of this chamber



are 46 ft. sq. giving a capacity of 19,040 c.ft., and it is cooled by another  $3\frac{1}{4}$  in.  $\times$  3 in. compressor similar to those on the first cold store, but driven by a 25 h.p. motor. Two coolers are also used and the condenser is of the standard shell and tube multipass type.

*Store No. 3*—This is 46 ft. long  $\times$  34 ft. wide with a capacity of 14,980 c.ft., and is used for the storage of meat and vegetables at a temperature of 32° to 35° F. The refrigeration unit is identical to that used for No. 2 store, but the compressor is driven by a 20 h.p. motor.

*Store No. 4*—The store, which is 46 ft. long  $\times$  30 ft. wide with a capacity of 16,560 c.ft. and is used for the storage of meat at a temperature of 32° to 35° F., is cooled by a 2 in.  $\times$   $1\frac{1}{4}$  in. six cylinder veebloc compressor driven by a 10 h.p. motor. Only one unit type air cooler is used, and, as in the case of all the other compressors, the refrigerant used is "Arcton-6."

#### A SWEDISH CABINET MANUFACTURER

A RECENT visit by "M.R.'s" representative to Aktiebolaget K. J. Levin of Malmö revealed that big developments are taking place there. Extensions to their two factories are now well advanced.

The main Levin factory is situated just outside Malmö, at a suburb called Lindesborg. The first stage of the new extensions was almost complete at the time of writing. This expansion includes the provision of new paint spray booths, new production areas and raw material storage bays. The next stage will entail the building of new offices and new "social" amenities such as canteens and rest rooms; completion of this phase will take place towards the end of the summer. Following this, there will be set in motion a development programme, embracing the production area and assembly hall, which will proceed during the autumn.

The other Levin factory is situated in Klässbol, which is a small village in the county of Värmland, in the middle of Sweden. Only a few miles south of Arvika, it is a town close to the Norwegian border. At this factory is undertaken the entire production of home- and farm-freezers and ice-cream conservators, employing approximately 110 hands.

Extensions have been in hand at Klässbol for several months. The building containing the new production area is ready, but some of the very latest types of machines ordered from the U.S.A. and Germany, will not be finally installed and working until some time in the spring.

This mechanization at Klässbol will increase several times the output without necessitating the employment of more personnel.

NEW FREEZER STORE  
Built for Eskimo frozen food users.



#### CONDITIONS IN DOMESTIC REFRIGERATORS

(continued from page 162)

This is an important factor in actual food storage life. Parenthetically, the separate closure on the compartment likewise minimizes cabinet usage effects.

(2) Moisture deposited on surfaces exterior to the sealed compartment during cabinet usage is evaporated readily by forced convection.

(3) To avoid freezing of the foodstuffs, temperature variations in the critical near-freezing zone must be minimized. Forced air, controlled by a reliable thermostat, helps solve this tolerance problem.

(4) Compartment surface temperature gradients must be minimized. Forced air directed to these surfaces achieves this objective.

(5) Creation of warmer zones in other cabinet regions may be desirable. A forced-air system can be divided to produce this higher temperature zone in the upper part of the cabinet while maintaining near-freezing temperatures within the compartment.

As stated previously, surface temperature gradients have an undesirable effect on the compartment humidity. There is, however, another more subtle and significant thermal mechanism stemming from the gradients. Convection currents may be induced within the compartment by uneven temperature distribution on the compartment boundary, especially if the top surface temperature is depressed.

## Good Prospects in 1960 FOR U.S. AIR-CONDITIONING AND REFRIGERATION

**A**LL records for the sale of all types and sizes of equipment using the "mechanical refrigeration" cycle promise to go by the board this year in America according to Geo. S. Jones, managing director of the Air-Conditioning and Refrigeration Institute.

This is not an isolated view.

At the 11th All-Industry Exposition, held during November at Atlantic City, the almost-200 exhibitors were virtually unanimous in expressing the belief that the come-back made by the industry in 1959 (after two years when the sales curve was considerably flatter than in the preceding decade) presaged a record-breaking 1960 and continued progress through the 60s.

The evidence is that when the figures are all in, it will be shown that 1959 sales of air-conditioning and refrigeration equipment ran by as much as 20 per cent. ahead of 1958 . . . and were 10 to 15 per cent. upon the best previous year—1956.

Manufacturers' shipments of compressors, the heart of any mechanical refrigeration or air-conditioning system and thus always a good indicator of industry activity, were running about 40 per cent. ahead of 1958 for the first nine months of the year.

### Standardizing Ratings

One of the factors behind the 1959 gains, in the opinion of Mr. Jones, has been the "unitary" certificate programme which was launched by the A-CRI at the beginning of the year to stabilize and standardize capacity ratings for "unitary" equipment (which includes all central residential installations and many smaller commercial and industrial "packaged" applications). In this way the buyer is provided with a yardstick when it comes to considering the acquisition of a home cooling system. About 90 per cent. of the manufacturers of "unitary" air-conditioners are participating in the programme—which is to be made even more widely known in 1960.

Another factor in the steep rise in sales has been the growing awareness of builders and the public of the truth of the declaration made by the Federal Housing Administration, that non-air-conditioned homes in many sections of the country will be obsolete within 10 years. Another aid has been the relaxation of FHA rules to encourage the installation of air-conditioning in FHA-financed homes.

But apart from central residential air-conditioning (in which the most spectacular sales gains are pretty certain to have been made) there was a continued upward trend throughout 1959 in the installation of big systems for the cooling of office buildings, apartments and hotels, industrial plants, etc. Early

estimates are that the installed value of such systems ran to more than \$600,000,000—a gain of about 10 per cent. over the figure for 1958. These figures represent "equipment in place," rather than the value of manufacturers' shipments and include the cost of installations, duct-work, grilles and other elements that go to make up the system.

Manufacturers of system components feel that the potential for this type of equipment is great—particularly in the industrial field. Contrary to a widespread belief in the United Kingdom, only about 10 to 15 per cent of U.S. factories are air-conditioned. But industrial managements are coming to recognize more acutely each year the economic benefits of air-conditioning through improved employee-health and morale.

In this connexion, the publication during 1959 of the results of a highly relevant study was of great value. This showed that the efficiency of office workers under controlled conditions of temperature and humidity was at least nine per cent greater in air-conditioned than in non-air-conditioned establishments.

Another area in which Mr. Jones has reported big gains for the air-conditioning industries is car-cooling. Although precise figures are not available, it is known that all the major motor manufacturers have stepped up the percentage of their cars which are coming from the production lines completely air-conditioned. Moreover, the production of units for post-buying installation in cars has shown a similar growth. The Society of Automotive Engineers have estimated that by 1962 one in nine cars will be air-conditioned. They have also predicted that 25 per cent. of all cars produced within five years will be factory-equipped with air-conditioning.

In the field of American commercial and industrial refrigeration, the longer-established phase of mechanical cooling, 1959 was an excellent year for most of the many products covered by this broad category. Moreover, forecasts of increased marketing facilities for foods (75 per cent. of which are mechanically cooled at some point along the pipeline from producer and processor to consumer), as well as developments in scientific and defence applications auger well for a further step-up in the utilization of refrigeration equipment.

Typical of the forecasts that have led manufacturers of refrigeration equipment to look to the future with optimism, is the prospect ahead for the frozen food industry. This was recently outlined by Harold J. Humphrey, president of the National Association of Frozen Food Packers. Citing the growth of frozen foods as a factor in American life, he predicted that "in the next three to four years, total frozen food production should be between 8.5 and 9,000,000,000 lb.—an increase of 1.5 to 2,000,000,000 lb." over production in 1959. As a consequence, new equipment would be needed, especially for trucks, backroom storage in retail stores, retail cabinets, "and of course, home refrigeration."

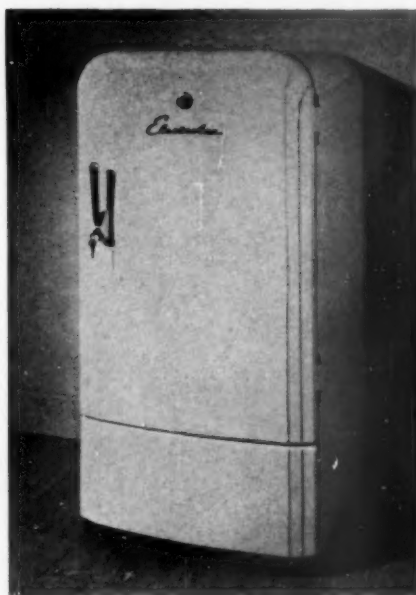
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# DOMESTIC REFRIGERATION DEVELOPMENTS



**New  
Electrolux  
5 c.ft.  
Refrigerator**



A new Electrolux 5 c.ft. model L.50, which provides 10 sq. ft. of shelf area, a full width frozen food compartment, three door shelves for bottles and small packages, special butter and cheese compartments, a cold tray, an interior light and a lockable door handle was announced last month.

The full-width frozen food compartment is fitted with a blue tinted translucent plastic door and is equipped with three ice trays to provide a total of 54 cubes of ice at each filling. The door storage shelves of blue, translucent plastic are easy to remove for cleaning; the top shelf can be used as an egg

rack and the centre shelf is adjustable in height to make room for the storage of tall bottles. Covered compartments at the top of the door give ample storage space for butter and cheese.

To keep fruit and salad vegetables fresh and crisp, the new Electrolux L.50 has a large covered vegetable drawer. It is supplied with a set of food containers, and there is a large cold tray for storing uncooked fish and meat.

The L.50 has a cabinet exterior of high-gloss enamelled steel and the interior is made of porcelain, enamelled in ice blue. There are four storage shelves and cabinets are

available in either white or cream.

Outside dimensions are:—

Height 4 ft. 5½ in.

Width 2 ft. 3½ in.

Depth 2 ft. 3½ in.

Inside dimensions are:—

Height 2 ft. 7½ in.

Width 1 ft. 7 in.

Depth 1 ft. 1½ in.

The model L.50 is available for operation by electricity, gas, paraffin or bottled gas.

Prices: Electric or gas £96 13s. 7d.

(including £14 18s. 10d. p.t.)

Paraffin £92 9s. 8d.

(including £7 14s. 11d. p.t.)

Bottled gas £100 4s. 7d.

(including £15 9s. 10d. p.t.)



## DOMESTIC REFRIGERATION



Creda 300 refrigerator showing full width freezing compartment, egg rack, dairy compartment, bottle storage and the quantity of food this 3 c.ft. refrigerator will hold. The door opens within its own width.



The Creda 475 refrigerator showing the very ample door storage capacity including egg rack and tall bottle storage. This model has salad crisper, automatic interior light and adjustable shelves to permit maximum storage. Door opens within its own width.

## Creda Enters the Field

Simplex Electric Co. Ltd., have introduced two new refrigerators, the Creda 475 and the Creda 300. Both are powered by Tecumseh sealed units. The Creda 475 has a capacity of 4.75 c.ft. and the Creda 300 3 c.ft. Supplies of the former will not be available until May and of the latter until June. Initial production will be restricted and, consequently, only token supplies will be reaching the shops, state the makers.

Both refrigerators have modern styling, namely, an uncluttered front and no protruding handles or hinges; the doors of both models open within their own width. The inside door panels include egg racks, dairy compartments and generous bottle storage space. Internal layout is designed for maximum storage with better-than-average spacing between shelves for greatest convenience in use. Extra large freezers provide ample room for frozen foods and ice-making. The Creda 475 additionally includes salad and soft fruit crisper, internal light and adjustable shelves. Both models have scratch and heat-resistant

Melamine working tops with "Splash-back" on which the thermostat control is mounted externally for easy and convenient temperature control.

**Specifications :**

Dimensions—Creda 475 Height to table top 36 in. ;  
Width 23  $\frac{1}{8}$  in. ;  
Depth (overall) 22  $\frac{1}{4}$  in.  
Creda 300 Height to table top 33 in. ;  
Width 19  $\frac{1}{8}$  in. ;

**DOMESTIC REFRIGERATION**

Depth (overall) 20  $\frac{1}{4}$  in.  
Optional extra plinth to raise height to 36 in. if desired.

Colour—white or cream (both models).

Voltage range—200/250v. a.c. only (both models).

Price—Creda 475 66 gn. (inclusive of purchase tax)

Creda 300 52 gn. (inclusive of purchase tax).

**New Models from Merseyside**



**Everest 375**



**Everest 435**

**"Everest" Refrigerators 1960 Programme.**—For the 1960 season, Merseyside Engineering (Refrigeration) Ltd., have announced additions and changes in their range of "Everest" domestic refrigerators. An increase in production is planned and additional capacity will be provided by a new factory now being built at Birkenhead.

Two further models in the popular-size bracket are included in the additions, the "Everest 375" and the "Everest 435"; with capacities of 3.75 and 4.35 c.ft., respectively. Both models are precision made in bonderized steel with plastic interior. From the design stage of these new "Everest" models the emphasis has been on dimensions to suit British kitchens whilst giving maximum capacity. Each model has heat-resisting table-top; and is

fitted with plastic feet, at front and rollers at the back. Over-all dimensions are: "375"—36 in. high, 22 in. wide, 23 in. deep; "435"—36 in. high, 22 in. wide, 24  $\frac{1}{2}$  in. deep. The "Tecumseh" compressor is incorporated and the deep-freezer is of the totally enclosed type. The "Everest 375" is 58 gn. including P.T., and the "Everest 435" 68 gn.

The capacity of the "Everest 390" has been increased to 4 c.ft. without increase in price.

The policy of Merseyside Engineering is to concentrate on compressor-type refrigerators only and the "250" absorption type model will be discontinued accordingly.

The company also announces that a new all-British "Everest" refrigerator of 5.35 c.ft. capacity is to be introduced.

## DOMESTIC REFRIGERATOR



### The Tricity "Four Point Two" Refrigerator

This new refrigerator—the first to be produced by Tricity—was wrongly illustrated in our last issue. Finished in ivory or white Epikote hard wearing enamel, it has a capacity of 4.2 c.ft. The door holds 8 pints of milk (or their equivalent) and has an enclosed butter/bacon compartment and a tuck-

away shelf to hold nine eggs. Four rubber wheels enable it to be moved easily for wall and floor cleaning—a brake lever assuring stability when at rest. Considerable attention has been given to scientific disposition of the shelves, and an interior light is fitted.

### The "Liquefreeze" System

Known as the "Liquefreeze" system, a process for the introduction of liquid nitrogen into insulated frozen-food containers for transit is being operated in the United States by a subsidiary of the Isbrandtsen Co. Inc., New York. The insulated container is loaded by the shipper with frozen food cartons and the liquid nitrogen is introduced into the container. The amount of nitrogen to be

introduced is determined by the food being shipped and the temperature at which it is to be delivered, as well as the length of the trip. The liquid nitrogen penetrates the cardboard cartons and wrappings, and by the absorption of the heat of the water of composition in the food, lowers the temperature of the food to a specified level. The nitrogen, which has changed from liquid to gaseous form through the absorption of the heat is removed from the container entirely and the container is sealed. It is then ready for transit.

# REFRIGERATION

for Freezing ★ Storage ★ Display



The cold store of Eskimo Foods Ltd., Cleethorpes, is noteworthy as the first large installation of its type in this country to use finned cooling grids. The two large chambers, each with a capacity of 400,000 ft.<sup>3</sup>, and a smaller room of 35,000 ft.<sup>3</sup>, are automatically maintained at -20° F. by compound compressors made by J. & E. Hall.

J. & E. Hall design and manufacture all types of refrigerating equipment for the freezing, storage and retail display of quick frozen foods.

## **J & E HALL LTD**

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Branches at BIRMINGHAM • BRISTOL • GLASGOW • MANCHESTER • NEWCASTLE  
Offices and Works: AUSTRALIA and CANADA  
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AP 103





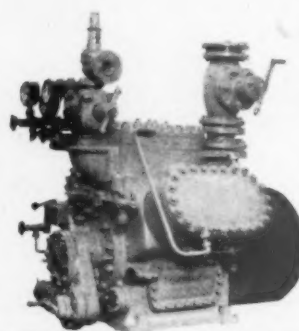
INDUCED DRAUGHT  
'FREON' CONDENSER



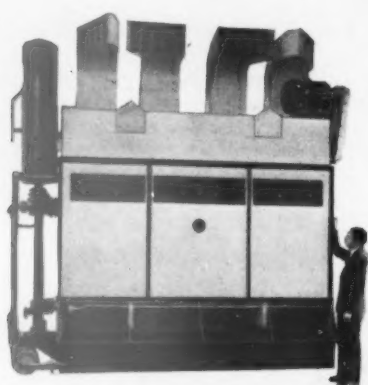
THE COMMERCIAL AND  
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EXHIBITION, 1960

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REFRIGERATION



MODEL A.56 AMMONIA COMPRESSOR



INDUCED DRAUGHT COOLER

For :

Ammonia  
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Compressors  
Condensers  
Coolers  
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For all purposes :

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# The Institute of Refrigeration Bulletin

*Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.A (CENTRAL 4694)*



*Photo: Rawood Ltd.*

## THE INSTITUTE CELEBRATES ITS DIAMOND JUBILEE

650 Members and Guests present at the Savoy Hotel, London

*(See also page 148)*

## OFFICERS OF THE INSTITUTE OF REFRIGERATION



Sir Rupert De la Bère, Bart. K.C.V.O., President (centre); Col. H. Randal Steward, T.D., Chairman of Council (third from right); Mr. Kenneth Lightfoot, O.B.E., Past-President (second from left); Mr. W. S. Douglas, past-president (extreme left); Mr. Theodore A. Raymond, Honorary Treasurer (second from right); Mr. D. T. Lee, Secretary (extreme right). Sir Samuel R. Beale, K.B.E. (third from left), has been a member of the Institute for nearly 50 years.

### FORTHCOMING MEETINGS MARCH 3 REFRIGERATED RAIL TRANSPORT

At the meeting of the Institute to be held on Thursday, March 3, 1960, at 5.30 p.m. at the Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London, E.C.3. Dr. E. Baumgartner will present a paper entitled "European refrigerated transport by railway."

The following is a synopsis of Dr. Baumgartner's paper:—

After a short historical summary the factors relating to refrigerated transport by railway are discussed, *i.e.*

- (a) Special cars—either with or without built-in cooling or heating equipment.
- (b) A special organization—to make available the cars as well as to maintain proper temperatures in transit *e.g.* by re-icing en route.
- (c) Products in good condition and properly packaged.
- (d) A market for refrigerated transport by railway.

Before going into these details, a definition of

perishable foodstuffs and "recommended" and "acceptable" temperatures for their transport are given.

The actual state of European refrigerated transport facilities as well as the trend of future development is treated. The author especially mentions the traffic from Italy to Great Britain via Switzerland.

The transport of perishables by containers is briefly referred to.

The author concludes that the importance of refrigerated transport in Europe for several reasons is still growing, *e.g.* by the fact that a limited producing area will have to provide food for an ever-increasing population, each group living far away from the other. It is probable that for the transport of deep frozen products the use of mechanically refrigerated railway cars will become more important as time goes on.

### MARCH 16—FRUIT COLD STORES

A symposium on "Construction of cold stores for fruit" is to be held at Ditton Laboratory on Wednesday, March 16, 1960, commencing at 10.30 a.m.

Full details of the meeting have already been forwarded to all members.



for thorough insulation—

## Polyurethane rigid foams

made from I.C.I. ISOCYANATES and POLYESTERS provide the refrigeration industry with an outstanding new material possessing excellent thermal insulating properties.

Additionally they combine the advantage of great lightness with rigidity and strength. Polyurethane Rigid Foams can be made easily in a wide range of densities.

The components can be conveniently mixed when and where needed and be simply poured or pumped into the desired position. The resulting foam can be relied on to withstand extreme cold and to resist heat.

Ask for details of Daltolacs 21, 22 & 24 <sup>(P)</sup> and Suprasec D <sup>(P)</sup>

<sup>(P)</sup> Patented in main industrial countries



Enquiries should be addressed to:

I.C.I. Sales Development Department (Polyisocyanates) Ship Canal House, King Street, Manchester, 2.

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Lustrex General Purpose, like all grades of Monsanto Lustrex, is a HIGH-QUALITY polystyrene. This and its special advantage of high clarity—now further improved—make it the ideal polystyrene for producing top-class, transparent mouldings. That's why you should always insist on Lustrex General Purpose—for sparkling, crystal-clear refrigerator fittings.

- Lustrex General Purpose is also available in a wide range of standard colours ; or, special colours can be accurately matched within a few days.
- There is a grade of Lustrex for every job in polystyrene.

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Regd. In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Limited, Montreal (Australia) Ltd., Melbourne. Monsanto Chemicals of India Private Ltd., Bombay. Representatives in

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and plastics  
help industry—  
to bring a better  
future closer



## COOLING PLANT *Recently Marketed*

### A NEW SALES AND DISPLAY CASE

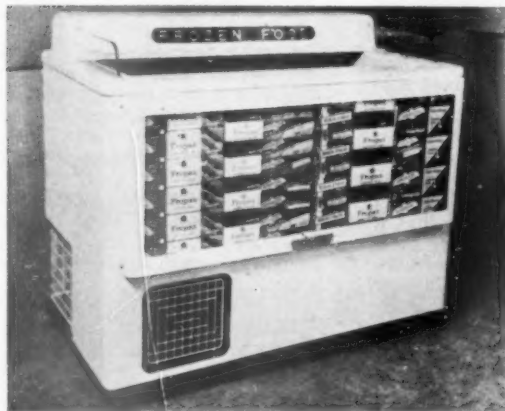
Prestcold Ltd., have introduced a deluxe version of the Farmoor fully automatic frozen food sales and display case with stainless steel trim and front panels available in a new choice of colours. Contemporary in design, the case is immediately eye-catching. Inside it an entire display can be illuminated and easily seen through the big, multi-glazed window. The display window consists of four sheets of plate glass, spaced and sealed to prevent misting. A heater strip around the display area of the cabinet prevents condensation. The Farmoor operates at about 5° F. and the correct temperature is automatically

To give every assistance to the shopkeeper who has installed or intends to purchase a plain-fronted frozen food cabinet, Eldwood Refrigeration are now manufacturing a dummy display case which can be fitted on the front of their nationally known county class frozen food cases. This attractive panel can easily be fitted to existing models and, although only costing £7, can display at least 55 variations of dummy packets. Giving a permanent display which cannot be disarranged by customer or assistant, this panel has the advantages that additional wall or floor space is not required.



maintained throughout the display compartment, up to the load line. Capacity of the cabinet is 388 lb. and the floor space required is 72½ in. by 32½ in.

### DUMMY DISPLAY FOR CASE



### NEW ICE-MAKERS



Prestcold



Frigidaire

# COMMERCIAL AND INDUSTRIAL SECTION

Rigid polyurethane foam applied by specially designed machines was used by the "J.D." Insulating Co. Ltd., Liverpool 20, in the insulation of eight provision rooms on the new Orient Line 37,000-ton tanker, s.s. *Garonne*. The total capacity of the rooms is approximately 3,550 c.ft. Linings consist of plastic laminated plywood to deckheads and white pigmented "Filon" corrugated plastics sheet to all vertical surfaces. Deck insulation is retained with resin-banded plywood sheets covered with a 1½-in.-layer of reinforced cement and black and white non-slip tiles. The doors, which were specially constructed to a lightweight design in keeping with the general insulation, consist of white stove enamelled alloy panels at the front and back with "Holo-plast" sides filled with rigid polyurethane foam. The doors are placed in Columbian pine main frames and hung on galvanized ball bearing hinges, and are complete with roller bolt fasteners and back-hooks. These doors show a saving of approximately two thirds the weight of the old type marine cold store doors.

The annual report of J. H. Fenner & Co. (Holdings) Ltd., Hull, states that the consolidated net profit of the group, after making provisions for deferred repairs and research expenditure, is £236,970 (compared with £226,055) for the year ended August 31st, 1959. The joint statement by the chairman, C. Bradshaw, F.C.A., and the managing director and deputy chairman, S. B. Hainsworth, F.T.I., says, *inter alia*, that the move towards general trade liberalization means that in their organization they must improve in cost cutting and in general efficiency, with lower profit margins per piece. Sales continue to expand and the company believes it is sharing in the general progress of business in Britain and abroad. Taking everything into consideration the prospects for the future are good.

Prestcold Finance Ltd., a privately owned company with an initial authorized capital of £200,000, has

been formed to carry on the business of hire-purchase financiers. The company has been formed by the Pressed Steel Company in conjunction with J. Henry Schroder & Co., the merchant bankers. It will finance instalment purchases of refrigeration products of the Prestcold division. The new company will be operating in early March.

It is learned that Messrs. John Harper, of Willenhall, Staffs—manufacturers of household and heating appliances—has concluded an agreement with Hermann Forster, of Arbon, Switzerland, for the sole U.K. manufacturing and selling rights of a Swiss 2½ c.ft. refrigerator, which will be marketed under the name of "Harper."

Chr. Salvesen and Co., Leith, Scotland, and Northern Cold Storage, are discussing the extension of their mutual interests in cold storage in England. It is confidently hoped that the result of these talks will be a substantial increase in existing sub-zero cold storage facilities.

Unilever N. V. has acquired Lucas Aardenburg N. V., a Dutch company producing frozen and tinned vegetables and fruit, which has a paid-up capital of Fls.1.5m. The increasing demand for deep-frozen food produced by the Unilever subsidiary, Vita, and the resulting need for more production capacity are stated to have led to this move. Lucas Aardenburg will integrate its deep-freeze operations with those of

Unilever. The company owns one factory in Holland and one in Germany, and produces mainly for the domestic market.

Iridon Ltd., one of the Commercial Plastics Group of Companies, have announced the addition to their London office staff of Mr. M. Flower, B.A. ECON. (CAMBS.) who has been appointed personal assistant to Mr. S. Majaro, sales director of Iridon, and Mr. A. F. Upton who is to be sales office manager.

The newly appointed refrigeration marketing manager of A.E.I.-Hotpoint Ltd., is Mr. Henry Walter Thompson. Educated at Ellesmere College, Shropshire, Mr. Thompson became an assistant superintendent in the Indian Police in 1939 being promoted to superintendent in 1944.



Returning to civilian life, he joined the Parker Pen Company as a salesman in 1948, and was appointed assistant sales manager in 1954. In 1956 he joined Christie Tyler as sales manager and came to Hotpoint in June 1957 as manager, South Eastern District. He was appointed Southern Division Sales Manager in December, 1957 and Marketing Manager Home Laundry in August, 1959.

Bakelite Ltd., have recently issued Advance Information Sheet B.36 entitled "Bakelite Phenolic Resin Foams." This gives details of a

**A NEW *Jackstone* FROSTER**

***BIG*... FOR BETTER PRODUCTION!**



**12 TONS**

THROUGHPUT every twenty four hours

*Jackstone*

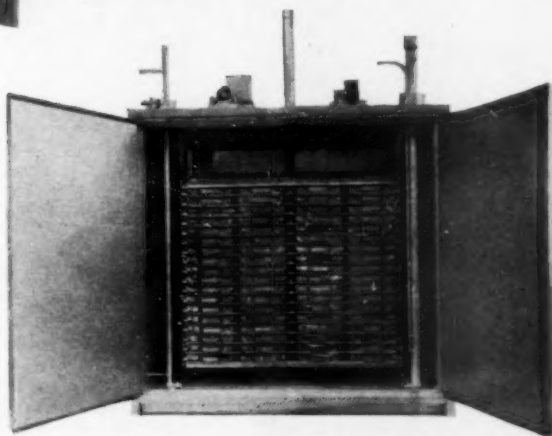
MODEL "A" 18 STATION  
DOUBLE CONTACT PLATE FREEZER

◀ PLATES OPEN FOR LOADING

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MODEL "A" 18 STATION  
DOUBLE CONTACT  
PLATE FREEZER

PLATES CLOSED  
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HUTTON ROAD  
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ENGLAND

***FASTER Freezing!***

## COMMERCIAL AND INDUSTRIAL

low-density cellular material recently developed for use in thermal insulation and as a light-weight core material for building panels. Information is also given on the special machines which have been developed for rapid mixing and dispensing of the foams. The company supplies the phenolic resin, foaming agent and hardener, which can be mixed and then poured into a mould for making into large blocks for cutting into slabs: alternatively, the mix can be poured into cavities for foaming *in-situ*. The complete mixing and foaming process takes less than 10 minutes and the foams, which do not support combustion, can be made into densities from 1 lb per c.ft. upwards. Copies of the leaflet are obtainable, free of charge, from Bakelite Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

A new vertical freezer which makes possible the storage of bulk supplies of packaged frozen foods



with easy access to the entire stock, is now being produced by the Prestcold Division of the Pressed Steel

Co. Ltd. Known as the Prestcold Caterer, the new freezer provides shelf storage for up to 500 lb. of frozen foods in nearly 15 c.ft. of space. Of all-steel construction to withstand hard use, the cabinet has concealed adjustable feet to enable it to stand firmly on uneven floors. For long-term storage, it will maintain a temperature of between 0° and 5° F. in ambient temperatures up to 90° F. The door-seal is of entirely new design and material, giving perfect sealing and easy closing. Fitted in the cabinet behind the door-seal, is an anti-freeze heater which prevents condensation and also, by preventing freezing-up around the door-sealing faces, ensures easy opening.

New contracts announced by the Expanded Rubber Co. Ltd., Croydon, include one for the supply of Polyzote expanded polystyrene for the insulation of six sling containers being built for the Harrison Line by Holmes (Preston) Ltd., and another for the insulation with Onazote expanded ebonite of a milk tanker being manufactured by the Cheshire Transport Co. Ltd., Stockport. To explain how Onazote can be used for the low temperature insulation of pipe lines and storage vessels, Expanded Rubber has recently issued an illustrated booklet which outlines the applications of the material. The company claims that Onazote has the lowest conductivity of any known rigid insulant. Its established K factor is 0.20 B.t.u. per sq. ft. hour °F per in. at a mean temperature of 50° F.

The semi-annual meeting of the American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., and the 2nd Southwest Heating and Air-conditioning Exposition, which includes heating, refrigerating, air-conditioning and ventilating, under the auspices of A.S.H.R.A.E., was held in Dallas, Texas, from February 1 to 4.

A new extension to its showroom has been opened in High Street, Dunfermline, by James Scott & Co. (Electrical Engineers) Ltd. In the lower ground floor of this extension, an area has been allocated for larger appliances including frozen food cabinets, refrigerated display units and similar lines.

A new service depot for London and the Home Counties has been

## MODERN REFRIGERATION

opened by the British Materials Handling Division of The Yale & Towne Manufacturing Company, at Ripple Road South, Barking, Essex. (Telephone: Dominion 5945).

In an article on the demands of population growth in Australia, the Australia and New Zealand Bank Ltd. Quarterly Review states that it has been estimated about 80 per cent. of all homes in the country supplied with electricity now have a refrigerator. Australia, on a population basis, is second only to the United States in ownership of refrigerators. Demand for "first-time" purchases is tending to fall towards the level of new dwelling completions, as the "saturation point" has been approached in the existing home market. New dwelling completions plus a large replacement demand will form the basis of the market in the future. As it has been estimated for several years that 80 per cent. of homes were equipped with refrigerators, it seems that the greater part of last year's record output (some 217,000 refrigerators) must have been absorbed by replacement demand. This demand can be expected to increase proportionately in the next 15 years, as obsolescence takes place.

Reed Corrugated Cases Ltd., have recently brought into operation a new board machine at their Brentford, Middlesex, branch. This machine, over 300 ft. long, incorporates the latest refinements in design. It will enable the factory to increase its production of wide corrugated fibreboard by several millions of square ft. per week, with the double effect of meeting an ever-growing demand and cutting down delivery times. The machine is constructed with devices to speed handling of materials at each end. Roller conveyors and turntables facilitate movement of the paper reels to the shaftless reel stands, which have push-button controls to enable the reels to be positioned quickly and precisely. Where the blanks come off the machine, electronic counters allow them to stack until a pre-set number is reached. These are then automatically moved forward to let the next stack form. By means of the duplex rotary cut-off, blanks of the same board quality, but of different dimensions, can be produced at the same time. Shortly after this new machine started operating, an addition to



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# ELDWOOD



**OVER THIRTY-FIVE  
DIFFERENT MODELS OF  
FROZEN FOOD CABINETS**

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Things looking up?



Business grows. Add a new machine. And grows and grows. Add a couple more. Sounds simple—till you start wondering

United

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of eight provision rooms on the new Orient Line 37,000-ton tanker, s.s. *Garonne*. The total capacity of the rooms is approximately 3,550 c.ft. Linings consist of plastic laminated plywood to deckheads and white pigmented "Filon" corrugated plastics sheet to all vertical surfaces. Deck insulation is retained with resin-banded plywood sheets covered with a 1½-in.-layer of reinforced cement and black and white non-slip tiles. The doors, which were specially constructed to a lightweight design in keeping with the general insulation, consist of white stove enamelled alloy panels at the front and back with "Holo-plast" sides filled with rigid polyurethane foam. The doors are placed in Columbian pine main frames and hung on galvanized ball bearing hinges, and are complete with roller bolt fasteners and back-hooks. These doors show a saving of approximately two thirds the weight of the old type marine cold store doors.

The annual report of J. H. Fenner & Co. (Holdings) Ltd., Hull, states that the consolidated net profit of the group, after making provisions for deferred repairs and research expenditure, is £236,970 (compared with £226,055) for the year ended August 31st, 1959. The joint statement by the chairman, C. Bradshaw, F.C.A., and the managing director and deputy chairman, S. B. Hainsworth, F.T.I., says, *inter alia*, that the move towards general trade liberalization means that in their organization they must improve in cost cutting and in general efficiency, with lower profit margins per piece. Sales continue to expand and the company believes it is sharing in the general progress of business in Britain and abroad. Taking everything into consideration the prospects for the future are good.

Prestcold Finance Ltd., a privately owned company with an initial authorized capital of £200,000, has

## INDUSTRIAL SECTION

been formed to carry on the business of hire-purchase financiers. The company has been formed by the Pressed Steel Company in conjunction with J. Henry Schroder & Co., the merchant bankers. It will finance instalment purchases of refrigeration products of the Prestcold division. The new company will be operating in early March.

It is learned that Messrs. John Harper, of Willenhall, Staffs—manufacturers of household and heating appliances—has concluded an agreement with Hermann Forster, of Arbon, Switzerland, for the sole U.K. manufacturing and selling rights of a Swiss 2½ c.ft. refrigerator, which will be marketed under the name of "Harper."

Chr. Salvesen and Co., Leith, Scotland, and Northern Cold Storage, are discussing the extension of their mutual interests in cold storage in England. It is confidently hoped that the result of these talks will be a substantial increase in existing sub-zero cold storage facilities.

Unilever N. V. has acquired Lucas Aardenburg N. V., a Dutch company producing frozen and tinned vegetables and fruit, which has a paid-up capital of Fls.1.5m. The increasing demand for deep-frozen food produced by the Unilever subsidiary, Vita, and the resulting need for more production capacity are stated to have led to this move. Lucas Aardenburg will integrate its deep-freeze operations with those of

Iridon Ltd., one of the Commercial Plastics Group of Companies, have announced the addition to their London office staff of Mr. M. Flower, B.A. ECON. (CAMBS.) who has been appointed personal assistant to Mr. S. Majaro, sales director of Iridon, and Mr. A. F. Upton who is to be sales office manager.

The newly appointed refrigeration marketing manager of A.E.I.-Hotpoint Ltd., is Mr. Henry Walter Thompson. Educated at Ellesmere College, Shropshire, Mr. Thompson became an assistant superintendent in the Indian Police in 1939 being promoted to superintendent in 1944.



Returning to civilian life, he joined the Parker Pen Company as a salesman in 1948, and was appointed assistant sales manager in 1954. In 1956 he joined Christie Tyler as sales manager and came to Hotpoint in June 1957 as manager, South Eastern District. He was appointed Southern Division Sales Manager in December, 1957 and Marketing Manager Home Laundry in August, 1959.

Bakelite Ltd., have recently issued Advance Information Sheet B.36 entitled "Bakelite Phenolic Resin Foams." This gives details of a

the factory was completed which provided additional space needed to cope with the greatly increased tonnage of fibreboard produced.

\* \* \*

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\* \* \*

Designed for high velocity air-conditioning duct work, a range of circular duct fittings made from mild steel sheet or aluminium has been introduced by **Wilmot Breeden**

#### DOMESTIC REFRIGERATION SALES MAINTAINED AT HIGH LEVEL

The Domestic Refrigeration Development Committee states that sales of domestic refrigerators run by electricity, gas, bottled gas and paraffin during November reached a total of 56,596.

Sales on the home market—a total of 50,095—increased by just under 100 per cent. on the same month last year—a total of 25,555.

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1958 — 528,497  
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A significant factor was the maintenance of an exceptionally high level of domestic refrigerator sales last autumn. In past years, sales have declined steeply during the autumn and winter months.

It is interesting to note that the November sales total last year was more than eight times that of November, 1956.

**Ltd.**, of Birmingham. They are to be marketed under the name **Velflo**. One of the most important advantages claimed for the fittings

#### COMMERCIAL AND INDUSTRIAL

is that the flow passages are smooth and of uniform curvature and thus offer minimum resistance, whether they are used for air conditioning, fume or dust extraction. There are no joints, rivets or folds to interfere with the air flow. The fittings are available in diameters ranging from about 3 in. to 12 in. and they include bends of 90, 60, 45 and 30 degrees.

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Some 43,000 sq. ft. of machine shop space have now been erected at the new Holme factory of **Thomas Sabroe & Co. Ltd.**, Aarhus, Denmark, according to "Sabroe



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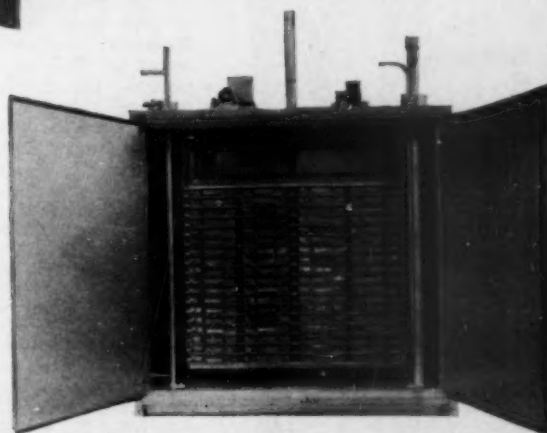
MODEL "A" 18 STATION  
DOUBLE CONTACT PLATE FREEZER

◀ PLATES OPEN FOR LOADING

### Jackstone

MODEL "A" 18 STATION  
DOUBLE CONTACT  
PLATE FREEZER

PLATES CLOSED  
FREEZING POSITION ▶



TELEPHONE  
GRIMSBY  
5 8 4 2 1

## Jackstone Froster Ltd.

HUTTON ROAD  
GRIMSBY  
ENGLAND

## FASTER Freezing!



## COMMERCIAL AND INDUSTRIAL

low-density cellular material recently developed for use in thermal insulation and as a light-weight core material for building panels. Information is also given on the special machines which have been developed for rapid mixing and dispensing of the foams. The company supplies the phenolic resin, foaming agent and hardener, which can be mixed and then poured into a mould for making into large blocks for cutting into slabs; alternatively, the mix can be poured into cavities for foaming *in-situ*. The complete mixing and foaming process takes less than 10 minutes and the foams, which do not support combustion, can be made into densities from 1 lb per c.ft. upwards. Copies of the leaflet are obtainable, free of charge, from Bakelite Ltd., 12-18 Grosvenor Gardens, London, S.W.1.

A new vertical freezer which makes possible the storage of bulk supplies of packaged frozen foods



with easy access to the entire stock, is now being produced by the Prestcold Division of the Pressed Steel

Co. Ltd. Known as the Prestcold Caterer, the new freezer provides shelf storage for up to 500 lb. of frozen foods in nearly 15 c.ft. of space. Of all-steel construction to withstand hard use, the cabinet has concealed adjustable feet to enable it to stand firmly on uneven floors. For long-term storage, it will maintain a temperature of between 0° and 5° F. in ambient temperatures up to 90° F. The door-seal is of entirely new design and material, giving perfect sealing and easy closing. Fitted in the cabinet behind the door-seal, is an anti-freeze heater which prevents condensation and also, by preventing freezing-up around the door-sealing faces, ensures easy opening.

New contracts announced by the Expanded Rubber Co. Ltd., Croydon, include one for the supply of Polyzote expanded polystyrene for the insulation of six sling containers being built for the Harrison Line by Holmes (Preston) Ltd., and another for the insulation with Onazote expanded ebonite of a milk tanker being manufactured by the Cheshire Transport Co. Ltd., Stockport. To explain how Onazote can be used for the low temperature insulation of pipe lines and storage vessels, Expanded Rubber has recently issued an illustrated booklet which outlines the applications of the material. The company claims that Onazote has the lowest conductivity of any known rigid insulant. Its established K factor is 0.20 B.t.u. per sq. ft. hour °F per in. at a mean temperature of 50° F.

The semi-annual meeting of the American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., and the 2nd Southwest Heating and Air-conditioning Exposition, which includes heating, refrigerating, air-conditioning and ventilating, under the auspices of A.S.H.R.A.E., was held in Dallas, Texas, from February 1 to 4.

A new extension to its showroom has been opened in High Street, Dunfermline, by James Scott & Co. (Electrical Engineers) Ltd. In the lower ground floor of this extension, an area has been allocated for larger appliances including frozen food cabinets, refrigerated display units and similar lines.

A new service depot for London and the Home Counties has been

opened by the British Materials Handling Division of The Yale & Towne Manufacturing Company, at Ripple Road South, Barking, Essex. (Telephone : Dominion 5945).

In an article on the demands of population growth in Australia, the Australia and New Zealand Bank Ltd. Quarterly Review states that it has been estimated about 80 per cent. of all homes in the country supplied with electricity now have a refrigerator. Australia, on a population basis, is second only to the United States in ownership of refrigerators. Demand for "first-time" purchases is tending to fall towards the level of new dwelling completions, as the "saturation point" has been approached in the existing home market. New dwelling completions plus a large replacement demand will form the basis of the market in the future. As it has been estimated for several years that 80 per cent. of homes were equipped with refrigerators, it seems that the greater part of last year's record output (some 217,000 refrigerators) must have been absorbed by replacement demand. This demand can be expected to increase proportionately in the next 15 years, as obsolescence takes place.

Reed Corrugated Cases Ltd., have recently brought into operation a new board machine at their Brentford, Middlesex, branch. This machine, over 300 ft. long, incorporates the latest refinements in design. It will enable the factory to increase its production of wide corrugated fibreboard by several millions of square ft. per week, with the double effect of meeting an ever-growing demand and cutting down delivery times. The machine is constructed with devices to speed handling of materials at each end. Roller conveyors and turntables facilitate movement of the paper reels to the shaftless reel stands, which have push-button controls to enable the reels to be positioned quickly and precisely. Where the blanks come off the machine, electronic counters allow them to stack until a pre-set number is reached. These are then automatically moved forward to let the next stack form. By means of the duplex rotary cut-off, blanks of the same board quality, but of different dimensions, can be produced at the same time. Shortly after this new machine started operating, an addition to



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DIFFERENT MODELS OF  
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Members of the Association of Frozen Food Stores recently met in London for the first time. They took luncheon at the Connaught Rooms with Refrigeration Press Limited and later discussed food storage matters with Dr. J. C. Fidler at the Covent Garden Laboratory. Mr. I. M. Ferguson, president, is fifth from right and Dr. Fidler sits on his right.



## COMMERCIAL AND INDUSTRIAL

News." When completed the machine shops will cover 129,000 sq. ft.

\* \* \*

Mr. Tom Clibbon left Teddington Refrigeration Controls Ltd. at the end of January to enter business on his account; it is understood that this activity will not be in the refrigeration field. Mr. Stephen S. Sherlock, sales director, writes:—"I am certain that you will join me in wishing him every good fortune in his new venture, and it is quite superfluous for me to add anything other than to say that I shall miss very much the co-operative enthusiasm he has always given." Mr. V. J. Lewis, who has been associated with TRC's technical sales department for some time and with the company for 22 years, will be taking over from Tom Clibbon.

\* \* \*

The Lightfoot Refrigeration Co. Ltd. of Wembley Middlesex, who this year celebrate their 75th anniversary, last month opened a new branch office at Canute Road, Southampton adjacent to Southern Cold Stores Ltd., their associated company. The occasion was marked by an informal meeting at the office attended by the company chairman, Mr. K. Lightfoot, O.B.E., Mr. J. A. Howie, managing director, Mr. T.D. Morison, director, and a few friends of long standing. The visitors were able to inspect a packaged water chiller which was awarded a grand prix at the Brussels Exhibition 1958 as well as equipment of more recent development, in the new showroom. Afterwards all met for lunch at the Polygon Hotel. The new branch will co-ordinate and extend the company's existing sales and service arrangements in the territory and will take care of an area covering approximately from Weymouth in Dorset to Hastings in Sussex and

Mr. Kenneth Lightfoot, O.B.E., and Mr. John A. Howie (second and third from left respectively) chat with Mr. H. E. White, Mr. W. Errington and Mr. A. F. Stead at the new Lightfoot branch at Southampton.



New type of frozen food cabinet referred to on page 149.

extending about 35 miles inland. Staff engineers at present stationed at Brighton and Portsmouth will be incorporated into the new organization. The branch manager, Mr. A. F. Stead, joined the Lightfoot Company as an engineer in 1935 and, with the exception of six years' war service in the R.A.F., has served continuously since then. He has wide experience in both commercial and industrial refrigeration and prior to this appointment was in charge of operations in Kent. Mr. F. Coveney who has worked for the company for many years both at home and abroad has been appointed engineering supervisor for the area. Informal meetings will be extended

to other Lightfoot friends over a period of a week or so.

\* \* \*

We learn that I.C.I. Plastics Division are to increase polythene production by approximately 15 per cent. in 1960, bringing the annual output to about 105,000 tons. Fears that there may be a shortage of polythene in the domestic market this year are therefore allayed. The supply position will be further improved by redeployment of I.C.I.'s total sales. As a result of the completion of new I.C.I. plants in India and Australia, and increased production in France and Germany, more polythene will be available for home distribution.





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**WIDE TEMPERATURE RANGE**

including

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**Temperatures : minus 20° F to plus 16° F**

**DATE OF COMPLETION — DECEMBER 1960**



## COLD LOGIC

When the problem is the lowering of temperature,  
it's a matter of cold logic to use 'Arcton' chlorofluorohydrocarbon refrigerants  
from I.C.I. — the first to introduce this type of refrigerant in Great Britain.  
(And the people with the greatest experience.)

Not that I.C.I. is resting on its laurels. Behind 'Arcton' refrigerants  
there's a background of constant research for further improvements.  
Wherever cooling is the problem, 'Arcton' refrigerants can provide  
the answer. They're of consistent high quality and low moisture content;  
and they're non-toxic, non-corrosive and non-inflammable. What's more,  
there's an 'Arcton' refrigerant to suit your need.

**'ARCTON' REFRIGERANTS**

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1



AR.46

# REFRIGERATION IN INDIA AND I

BY M. L. KHANNA, B.Sc. in E.E., C.E.E., MEM: ASHRAE, M.INST.R., M.R.S.H.

(Continued from January)

IN introducing refrigeration and all that is allied to it, my biggest difficulties in the Government were convincing my non-technical colleagues of the necessity of this science and arranging for the supply of the steel to be used for buildings and in the manufacture of some parts of plant, the power that was required to operate heavy plants, the water necessary for huge condensers and for the making of ice, the transport of heavy plant and machinery, and convincing the Import Authority to permit import from hard currency areas, particularly the U.S.A. and U.K. Australian and European manufacturers, I knew, could help but the period of delivery for the much-needed equipment was long and the prospective owners of the plants in question would not wait. I was told that there were some ice and cold-storage plants which had become surplus to the defence requirements of the country most of which had come from the United Kingdom and all of which were made available to some of the local users including refugees. A start, of course, was made and the work went on unhampered. I managed to acquire steel and electric power, and also a number of wagons to move imported plant and machinery inland from the seaports. I got water from wells for condenser cooling and with the co-operation of all departments concerned, ice began to be sold in the streets of Delhi at about two annas a pound as against 12 annas the previous years. The prices of potatoes came down slightly in a similar manner. It is interesting to note that the wastage in seed potatoes alone in the potato growing areas of India amounts to about 50 per cent. of the crop produced, and the potatoes are a poor man's food.

While all this work was progressing Government officials frequently told me: "Refrigeration is a luxury." Some of them went as far as to say that it was a rich man's game. My answer was always that refrigeration is a poor man's gain. The many millions being spent for the "Grow More Food" campaign would only bring more land under cultivation, would only grow more food; the point I pleaded with my superiors was that wastage must be cut. The eating habits of the people would in time change. There should, I contended, be a "Save More Food" campaign side by side with "Grow More Food." Growing more food and continuing to waste it would obviously not solve the problem.

Cold storage plants are coming up, said my former colleagues and the whispers amongst some of them gave just another story. These whispers actually started from some of the orthodox owners of plants when they heard me talking about saving such foods as eggs, meats, fish, etc., and besides, these very owners, hoping to gain financially during the first year or so of their enterprises, began to seek for monopoly of the trade and my troubles began. Some of the research workers spread more whispers. How does Mr. Khanna know what temperatures and humidity conditions are needed for different kinds of perishable foods with which he is dealing. They had evidently forgotten that I had spent some months with some of the leading men of science in Cambridge and they were also not aware of the fact that I had spent years in the U.S.A. doing this very kind of work. Besides all this, with the coming on of partition and dependence, human jealousies arose and I found myself a very lonely man fighting a huge battle.

The suppliers of plant and machinery were with me more or less, and the capital (much of it surplus from war profits) was there too. I was fortunate, in addition, that some far-sighted officials were with me also. I continued my work. The opening of one project upon which I was engaged, the erection of an ice plant and a cold store in a town near Delhi was attended by Members of Parliament and high Government officials. "So this is the way ice is produced," said one of them, when huge

300-lb. blocks came out of the ice tank two at a time, by the help of a manually operated ice crane. "It is very cold here," said another when he visited a cold chamber in which nearly 100 tons of seed potatoes were stored. Great support was given to me in my work by the Press and much was done by the publicity officers attached to the Ministry of Agriculture.

Turning to the technical side of my work; probably the most significant factor I had to consider was the climate. The country can be divided into four district regions. In areas such as Assam, the maximum dry-bulb temperature will be somewhere around 95° F. with a high relative humidity. However, in West Bengal the temperature will go up to more than 100° F. with a high relative humidity.

In regions such as Delhi, Orissa, Bihar, Uttar Pradesh, Punjab, Rajasthan, Madhyabharat, Vindya Pradesh and Bhopal, the design temperatures should be based between somewhere around 105° to 108° F. and these areas for all purposes can be called dry except for monsoon weather which occurs during the months of July and August.

In places such as Bombay and Madras the design temperatures should not exceed 100° F. even though at Madras they have been registered higher. These two areas are very hot and during monsoon weather the relative humidity goes as high as 90 per cent. and even more.

For the States of Mysore and Travancorecochin the design dry-bulb temperatures are somewhere around 92° F. and even though Travancorecochin is higher in humidity, Mysore State is dry for all purposes.

All the above temperatures are averages for summer months only.

The necessity of treating each region separately when considering the design of a refrigeration or air-conditioning plant can be seen from the above data.

With the weather conditions understood, let me give some information concerning the design of ice and cold-storage plants:—

## Ice Plants

Sizes in common use range from 5 to 25 tons of ice per day and any combination thereof for still heavier capacities.

- (i) **Ammonia Compressors**: These are the usual twin-cylinder vertical single-acting types ranging from a 2 in. by 2 in. each cylinder to 10 in. by 10 in. Drives are mostly through a set of V-belts to a suitable electric motor.
- (ii) **Condensers**: For hot and dry areas such as East Punjab, Rajasthan, Delhi, Uttar Pradesh, etc., I have always preferred the atmospheric type with water falling on the outside of pipe network, and for other areas I suggest shell and tube type. In this case, however, some arrangement is necessary for the prevention of scale and an electronic process for treatment of water is available. I have never been in favour of the evaporative type of condenser because: (a) there are too many electrically driven moving parts; and (b) in high humidity areas such as Bombay, Cochin, Madras and Calcutta, the thin metal casings are always eaten up by rust, etc.
- (iii) **Ice Cans**: These are mostly of 200 and 300 lb. capacity and a smaller number of 112-lb. sizes. Dimensions respectively are 11 in. by 22 in. by 32 in., 11 in. by 22 in. by 46 in. and 8 in. by 16 in. by 38 in.
- (iv) **Ice Tanks**: These are from 4-in. M.S. plates and are now usually erected at site from steel made available from local sources.
- (v) **Ice Tank Coils**: These started with coils between cans and ended up with the flooded types with an accumulator placed at one side of the ice tank. Some engineers prefer



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ALL-66



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IN introducing refrigeration and all that is allied to it, my biggest difficulties in the Government were convincing my non-technical colleagues of the necessity of this science and arranging for the supply of the steel to be used for buildings and in the manufacture of some parts of plant, the power that was required to operate heavy plants, the water necessary for huge condensers and for the making of ice, the transport of heavy plant and machinery, and convincing the Import Authority to permit import from hard currency areas, particularly the U.S.A. and U.K. Australian and European manufacturers, I knew, could help but the period of delivery for the much-needed equipment was long and the prospective owners of the plants in question would not wait. I was told that there were some ice and cold-storage plants which had become surplus to the defence requirements of the country most of which had come from the United Kingdom and all of which were made available to some of the local users including refugees. A start, of course, was made and the work went on unhampered. I managed to acquire steel and electric power, and also a number of wagons to move imported plant and machinery inland from the seaports. I got water from wells for condenser cooling and with the co-operation of all departments concerned, ice began to be sold in the streets of Delhi at about two annas a pound as against 12 annas the previous years. The prices of potatoes came down slightly in a similar manner. It is interesting to note that the wastage in seed potatoes alone in the potato growing areas of India amounts to about 50 per cent. of the crop produced, and the potatoes are a poor man's food.

While all this work was progressing Government officials frequently told me: "Refrigeration is a luxury." Some of them went as far as to say that it was a rich man's game. My answer was always that refrigeration is a poor man's gain. The many millions being spent for the "Grow More Food" campaign would only bring more land under cultivation, would only grow more food; the point I pleaded with my superiors was that wastage must be cut. The eating habits of the people would in time change. There should, I contended, be a "Save More Food" campaign side by side with "Grow More Food." Growing more food and continuing to waste it would obviously not solve the problem.

Cold storage plants are coming up, said my former colleagues and the whispers amongst some of them gave just another story. These whispers actually started from some of the orthodox owners of plants when they heard me talking about saving such foods as eggs, meats, fish, etc., and besides, these very owners, hoping to gain financially during the first year or so of their enterprises, began to seek for monopoly of the trade and my troubles began. Some of the research workers spread more whispers. How does Mr. Khanna know what temperatures and humidity conditions are needed for different kinds of perishable foods with which he is dealing. They had evidently forgotten that I had spent some months with some of the leading men of science in Cambridge and they were also not aware of the fact that I had spent years in the U.S.A. doing this very kind of work. Besides all this, with the coming on of partition and dependence, human jealousies arose and I found myself a very lonely man fighting a huge battle.

The suppliers of plant and machinery were with me more or less, and the capital (much of it surplus from war profits) was there too. I was fortunate, in addition, that some far-sighted officials were with me also. I continued my work. The opening of one project upon which I was engaged, the erection of an ice plant and a cold store in a town near Delhi was attended by Members of Parliament and high Government officials. "So this is the way ice is produced," said one of them, when huge

300-lb. blocks came out of the ice tank two at a time, by the help of a manually operated ice crane. "It is very cold here," said another when he visited a cold chamber in which nearly 100 tons of seed potatoes were stored. Great support was given to me in my work by the Press and much was done by the publicity officers attached to the Ministry of Agriculture.

Turning to the technical side of my work; probably the most significant factor I had to consider was the climate. The country can be divided into four district regions. In areas such as Assam, the maximum dry-bulb temperature will be somewhere around 95° F. with a high relative humidity. However, in West Bengal the temperature will go up to more than 100° F. with a high relative humidity.

In regions such as Delhi, Orissa, Bihar, Uttar Pradesh, Punjab, Rajasthan, Madhyabharat, Vindya Pradesh and Bhopal, the design temperatures should be based between somewhere around 105° to 108° F. and these areas for all purposes can be called dry except for monsoon weather which occurs during the months of July and August.

In places such as Bombay and Madras the design temperatures should not exceed 100° F. even though at Madras they have been registered higher. These two areas are very hot and during monsoon weather the relative humidity goes as high as 90 per cent. and even more.

For the States of Mysore and Travancorecochin the design dry-bulb temperatures are somewhere around 92° F. and even though Travancorecochin is higher in humidity, Mysore State is dry for all purposes.

All the above temperatures are averages for summer months only.

The necessity of treating each region separately when considering the design of a refrigeration or air-conditioning plant can be seen from the above data.

With the weather conditions understood, let me give some information concerning the design of ice and cold-storage plants:—

## Ice Plants

Sizes in common use range from 5 to 25 tons of ice per day and any combination thereof for still heavier capacities.

- (i) **Ammonia Compressors**: These are the usual twin-cylinder vertical single-acting types ranging from a 2 in. by 2 in. each cylinder to 10 in. by 10 in. Drives are mostly through a set of V-belts to a suitable electric motor.
- (ii) **Condensers**: For hot and dry areas such as East Punjab, Rajasthan, Delhi, Uttar Pradesh, etc., I have always preferred the atmospheric type with water falling on the outside of pipe network, and for other areas I suggest shell and tube type. In this case, however, some arrangement is necessary for the prevention of scale and an electronic process for treatment of water is available. I have never been in favour of the evaporative type of condenser because: (a) there are too many electrically driven moving parts; and (b) in high humidity areas such as Bombay, Cochin, Madras and Calcutta, the thin metal casings are always eaten up by rust, etc.
- (iii) **Ice Cans**: These are mostly of 200 and 300 lb. capacity and a smaller number of 112-lb. sizes. Dimensions respectively are 11 in. by 22 in. by 32 in., 11 in. by 22 in. by 46 in. and 8 in. by 16 in. by 38 in.
- (iv) **Ice Tanks**: These are from 1-in. M.S. plates and are now usually erected at site from steel made available from local sources.
- (v) **Ice Tank Coils**: These started with coils between cans and ended up with the flooded types with an accumulator placed at one side of the ice tank. Some engineers prefer

the shell and tube type brine coolers, but I am not in favour of these because of the danger of tubes freezing through negligence on the part of the operator. Also, the use of coils in between cans is out of date.

- (vi) *Ice Cranes*: These are normally hand operated lifting one to two 300-lb. cans at a time or four each of 122-lb. and 200-lb. sizes at a time. There are instances, however, where heavier electrically driven lifts have been used in the recent past.

- (vii) *Air Agitation*: A very popular method of air agitation is the low-pressure type with an air blower passing air through headers, laterals and drop tubes, etc., to all the cans in a tank. The air pressure is usually  $1\frac{1}{2}$  to 2 lb. The ice, by this method, becomes crystal clear and by resorting to core sucking, the core can be made clear as well. This, however, invariably is not done by the ice plants in India due mainly to not very strict supervision.

Important in the manufacture of ice is the availability of good filtered water, and manufacturers must lay emphasis on this factor. In most larger cities municipal filtered water is available. There are, however, instances where well water has been used after it has been declared fit for human consumption, but one can well imagine the quality of ice in either case.

#### Cold Storage

Cold stores in India started a few years ago for the bulk storage of seed potatoes in order to assist the "Grow More Food" campaign of the Government, and the plants to operate them use both the direct expansion of ammonia and "Freon-12." The sizes range from 300 tons of product to about 1,500 tons of product with 2, 4, 6 and 8 chambers. The usual formula used for space requirement particularly for seed potatoes is 150 c.ft. for 1 ton of product. This formula will, of course, differ for different products. In "Freon" plants, cold diffusers are placed in each chamber depending upon the sizes required. In ammonia plants there are instances where both direct expansion and brine cooling are resorted to. Cold diffusers are employed with fans operating from electrically driven motors. The insulation material used is usually cork, but other types have been introduced recently for temperatures ranging between  $36^{\circ}$  F. and  $40^{\circ}$  F. inside.

There are a few instances where freezing techniques are employed, particularly for items such as fish and meats, etc.

The distribution of cold stores in India (erected between 1946—when the Refrigeration Division was created in the Ministry of Agriculture—and the present time) is given below:—

Bihar	...	...	16
Bombay	...	...	12
Delhi	...	...	8
Jammu and Kashmir	...	...	1
Madhya Bharat	...	...	3
Madhya Pradesh	...	...	3
Madras	...	...	5
Orissa	...	...	1
Punjab	...	...	9
Rajasthan	...	...	3
Saurashtra	...	...	1
Uttar Pradesh	...	...	38
West Bengal	...	...	14

In cold stores, the usual design has been the building of an air-lock round which two or four chambers are situated. The machine room is at the back and the front is occupied by verandahs for the purposes of grading the produce received. The cooling tower is mostly situated near the machine room at the back. Machinery imported from abroad for cold-storage plants amounts to approximately 80 per cent. from U.S. manufacturers and about 12½ per cent. from Britain. The rest comes from Denmark, France, and Australia. The total capital invested by private enterprise has exceeded RS. 10 crores\*, and the Government has financed the erection of a small number of plants to the extent of about 1 crore. These installations have been of a pilot plant nature so designed that the sizes could easily give the results obtained on a bulk-storage basis.

The position to-day is rather critical as far as the private capital is concerned because the guidance which came from the Refrigeration Division in the Ministry of Agriculture (now Food and Agriculture) is not available. Also the planned develop-

ment, which was originally the subject of the day, has for all practical purposes failed. Development of methods for moving refrigerated produce, particularly in the hot weather, must be undertaken. Refrigerator cars, vans, or trucks are needed but the railway departments have unfortunately not been able to bring a large number of these vehicles into use because of lack of demand. To my mind, this is unsatisfactory and the only way that an all-India refrigerator van service can be created would be by co-operation between plant owners. The practice to-day is that anyone can go to a cold store and buy or remove oranges he has stored to a distant place in ordinary vans in hot weather. The remover does not worry but the receiver often finds that a considerable part of his goods has perished before he can resell.

The refrigeration industry in India is still in a state of boyhood and my fears are that it is not receiving the attention it deserves either from the Government of India or from the trade itself. Due to shortages of foreign exchange, particularly sterling and dollars, the trade is not getting the import licences which are so necessary to keep up the good work.

The Government of India is not, I believe, short of foreign exchange, but Government sponsored imports are so heavy that not much can be spared for the private sector. This policy is retarding the development of a refrigeration industry and the situation should be reviewed.

India does manufacture room coolers, direct expansion "Freon" coils and condensers and domestic refrigerators, mostly in collaboration with U.K. and U.S.A. concerns. Local sources now manufacture all the components necessary for ice plants except ammonia compressors; here it is heartening to know that two prominent refrigeration interests in India are starting, in partnership with a well-known British manufacturer of refrigeration equipment, the manufacture of ammonia and "Freon" compressors and allied equipment in India. One cannot wish them greater luck than I do.

\*1 crore = £750,000.

## Correspondence

### Thirty-three Years in the Refrigeration Trade

TO THE EDITOR  
MODERN REFRIGERATION,

Sir,—Having been in the refrigeration trade for the whole of the period 1926 to 1959, I feel that I can safely give some advice to those who are in it to-day.

In 1926 we had to convince the butcher that mechanical refrigeration was more hygienic and easy to handle, and cheaper to operate, than the old ice box. In those days they bought a block of ice and some salt, and hoped it would give satisfactory results in a very poorly insulated cold room (the majority were only insulated with sawdust). When they did eventually decide to have them converted, it was often found that the sides of the box were only half, and sometimes less, insulated, as the sawdust had settled with years and left a gap at the top. To-day they can have a room made to specification, with perfectly fitting doors and all the necessary interior fittings, and can set their fridge to operate at the desired temperature for the commodity they are handling.

It is surprising how many so-called refrigeration engineers are not fully qualified, and not able to work out the actual B.t.u. extraction required. This is one of the big drawbacks at the present day. Any electrician, plumber or hardware dealer will undertake to supply you with a fridge. I asked one to give me some idea of how the different types operate, and why some require a heating unit to enable them to operate. All he could say was that it had to be there. He could not explain anything about the absorption plants, their relative running costs, or even the actual refrigerants used. It annoys me to think that people like this are allowed to call themselves refrigeration experts. It also annoys me to think that many firms employ representatives on a commission basis only to sell such highly technical equipment.

I remember watching a so-called refrigeration expert installing a plant for a butcher. For over three weeks he tried to get rid

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of back frosting to the compressor, but he was unsuccessful. Eventually another firm was called in to solve the problem. They found that the coil consisted of a mass of self wound copper tubing with no valves or controls, so a new coil was installed. The man in charge of the coil installation drilled the sides of the box to insert his bolts to hold it in position, and the result was that the bolt heads outside the box were blocks of ice and the condensation on the bolts was mining the insulation. A third firm was called in to finish the job. I don't know how they went on for the payments for all this from the butcher. He was to blame for looking for a cheap job in the first place, and personally I think that he ought to have paid for his own errors.

I notice that some modern butchers are installing two fridges these days, one for storage only and the other for general use. It saves both the quality of the meat and fridge running cost,

and gives more satisfaction.

Some firms are quoting for plants to operate two and three different temperatures from the one compressor, but I am firmly convinced this will never be a success. Other firms undertake to convert old  $\text{SO}_2$  plants to "Freon" and other refrigerants, but actual facts have proved that these things cannot be done satisfactorily.

Wholesale grocers in Lancashire have recently been selling frosted food cabinets at a much reduced price to enable them to open up new customers. This is also deplorable and I contend that they are trespassing on the refrigeration trade, just as much as the plumbers and electricians. If they would all keep to their own trades it would make for more satisfied customers, and better results all round.

Yours, etc.,

CLAUDE A. H. BROWN.

## REFRIGERATION SERVICEMEN'S ASSOCIATION — NEWS

**T**HE large attendance showed the interest aroused by the "questions and answers" programme that took the place of the customary lecture at the January meeting of the R.S.A.

The questions were mainly concerned with sealed systems and this emphasis reflected the fact that in the commercial field they are ousting open-type units.

The opening question queried the effect caused by inadvertently mixing "F-12" with "F-22" in a system. From the reply we learned that in the U.S.A., in certain cases, such as low temperature work, a small quantity of "F-12" mixed with "F-22" in a system assists in the return of oil to the compressor without adversely affecting the pressure curve.

A study of the temperature/pressure relationship chart will show that a drop of capacity occurs if too much "F-12" is added. With the increasing use of "F-22" a study of the data plate on a plant is advised when servicing plants.

Another point made was that the large volume of the compressor casing of a sealed system prevents, to a large extent, oil carry-over when working on a low suction pressure.

A plea for the repositioning of the relay and overload assembly on sealed systems to make for ease in servicing was met by a detailed explanation proving that the overload, as a motor protector, must be as near the motor windings as possible. Heat causes the bi-metal strip in the overload to function; therefore, if the overload is not close to the windings, and only acting as a current protector, it loses a large percentage of its effectiveness.

The formation of scale inside copper tubes during brazing was discussed. It was learned that a clean tube can be assured by passing a small stream of inert or coal gas through the tube during the brazing operation. The volume of gas is proved by a small flame light at the end of the tube.

Moisture in a system, especially if operating on  $\text{CH}_2\text{Cl}_2$ , has been attributed as a cause of copperization and gumming up of the oil. As the result of experiments in the U.S.A., it is learned that a possible cause may be minute quantities of air left in the system. It would appear that even in a system adequately purged under a high vacuum, a certain amount of

copperization takes place. This is of interest when considering the air globules in the motor windings of a sealed system.

A warning note was given respecting galvanized pipe coils. To prevent oil gumming by mixing with the pickling acid used in galvanizing, and not thoroughly cleaned before assembly and installation, the pipes are cleaned with trichlorethylene followed by drawing a high vacuum before the installation.

Types of leak detectors were discussed, with butane being adjudged a slow reactor and the electronic type unnecessary except for assembly work and persistent or minute leaks difficult to detect by the usual halide torch.

Questions on expansion valves included the determining of superheat on low temperature work by the use of a thermometer clamped at the phial of the expansion valve on the suction line. We were told that a knowledge of the capacity of an expansion valve is desirable to enable the correct size to be fitted. This knowledge enables the full capacity of the plant to be used and can prevent complaints such as hunting, hammering, etc.

The trouble to be expected when systems are topped up with the incorrect refrigerant was given by quoting the cleansing effect "F-12" has in a  $\text{CH}_2\text{Cl}_2$  system. Lack of refrigeration can occur by the choking up of strainers or dryers.

The cumulative effect of  $\text{CH}_2\text{Cl}_2$  when inhaled was pointed out. It would appear that in some cases unfamiliarity with this refrigerant prevents doctors being useful when first attending the patient. The writer experienced this some years ago. From this it would appear that servicemen should study the instruction chart issued by the I.C.I. and which should be found hanging in the workshop.

The R.S.A. have been advised by the Air Ministry that vacancies exist for civilian employees in Aden and the Persian Gulf. Particulars can be obtained from the honorary secretary or the Air Ministry, Theobalds Road, London, W.C.1. The field of our recognition is widening.

Nigeria has joined us with a block enrolment of 12.

Pressure of business has deprived the R.S.A. of the valuable services of Mr. Woodmore. This is all the more regrettable as he was a member of the educational sub-committee.

"Halogenated refrigerants" was the subject of the lecture held January 25. This will be followed on February 24 by "Automatic controls." The latter is always a popular subject. This lecture also will be given at 71, Queensbury, London, W.2. As is usual, both members and visitors who are interested in the Association's activities are welcome.

### OBITUARY

**Mr. H. V. Ellis**

We announce with regret the death on December 21, at Chalfont Hospital, of Horace Victor Ellis. Mr. H. V. Ellis, who was 62, was a director of the City Electrical Company.

## A Completely Hermetic Package Absorption Machine

Absorption refrigeration is not new. The first continuous heat-operated machine was patented in the middle of the 19th century. Since that time, other manufacturers, working with the same basic principles, have made many improvements in machine design and operation.

As part of an intensive company research and product development programme, Trane company en-

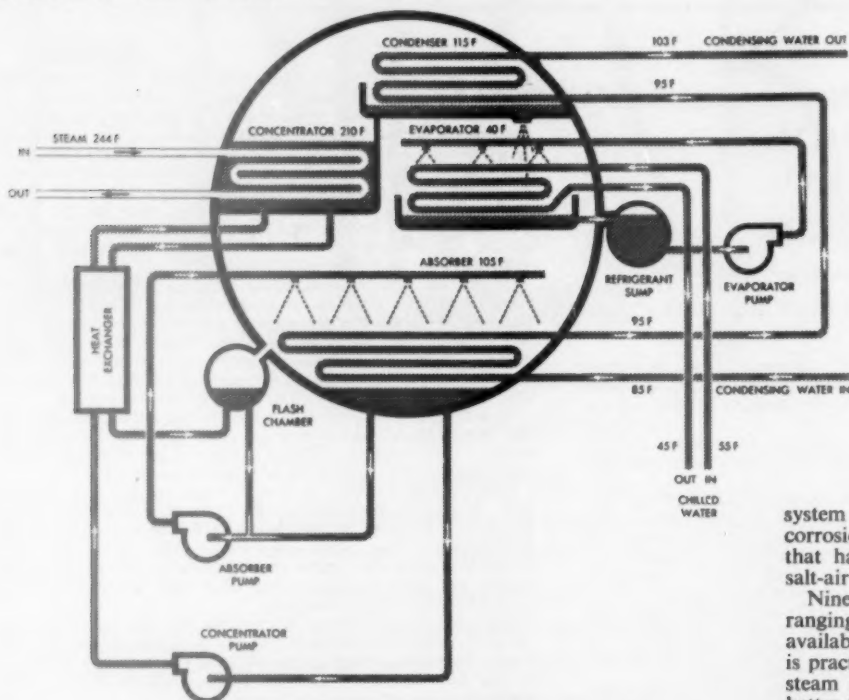
temperature as much as 10 degrees.

There was also the common and quite serious problem of absorbent crystallization. When the salt solution used in absorption systems becomes too concentrated for lower temperatures which may occur, it begins to congeal or crystallize and causes the unit to "freeze-up." When this occurs, the unit requires costly and time-consuming maintenance.

### Completely Hermetic

Self-lubricating and cooled centrifugal hermetic pumps (absorber, concentrator and evaporator), are used on the absorption cold generator. By using hermetic pumps, air leakage—so common on pumps that employ shaft seals—cannot occur. By preventing air leakage into the system, the absorption cold generator can better operate under those pressure-temperature characteristics peculiar to the absorbent-refrigerant mixture to produce the required cooling.

Preventing air from entering the



Schematic diagram of absorption cold generator operational cycle.

gineers at La Crosse, Wisconsin, have studied existing absorption machines to determine the desirability of adding a refrigeration unit of this type to the broad line of Trane reciprocating and centrifugal compressors.

In examining absorption machines, Trane engineers concluded there was room for improvement. Absorption machines operate under a vacuum, and air leakage was a serious problem. Open pumps, used on existing machines, tended to leak and allow air seepage into the system. This reduces cooling capacity. A pressure increase of .1 inch will increase chilled water

Trane engineers set out to overcome these design deficiencies.

### Absorption Cold Generator

Now, after extensive and rigorous testing in the Trane Research and Testing Laboratories, company engineers have developed a unit which is claimed to be an improvement over other absorption machines. This new machine, which is called the absorption cold generator, uses hermetic pumps which prevent air leakage into the machine. The new unit is less apt to be shut down because of absorbent crystallization. And, it is more compact and easier to install.

system also avoids the accelerated corrosion to metals within the unit that happens when a concentrated salt-air atmosphere exists.

Nine basic sizes, with capacities ranging from 100 to 350 tons, are available. Multiple unit installation is practical because the full capacity steam rate of any one machine is better than part capacity steam rate of a single large machine at part load conditions. Because the unit is quiet and almost vibration-free, it can be installed anywhere that will support its weight—in basement or on intermediate floor or roof. Because of its automatic operation, no full-time attendant is needed for the cold generator. The unit is shipped as a package, completely piped and wired. External insulation is usually unnecessary. Access for maintenance of internal components is provided from either end of the Trane machine. If a contractor wishes to install the unit near a wall, he need not worry about which end is designed for accessibility.

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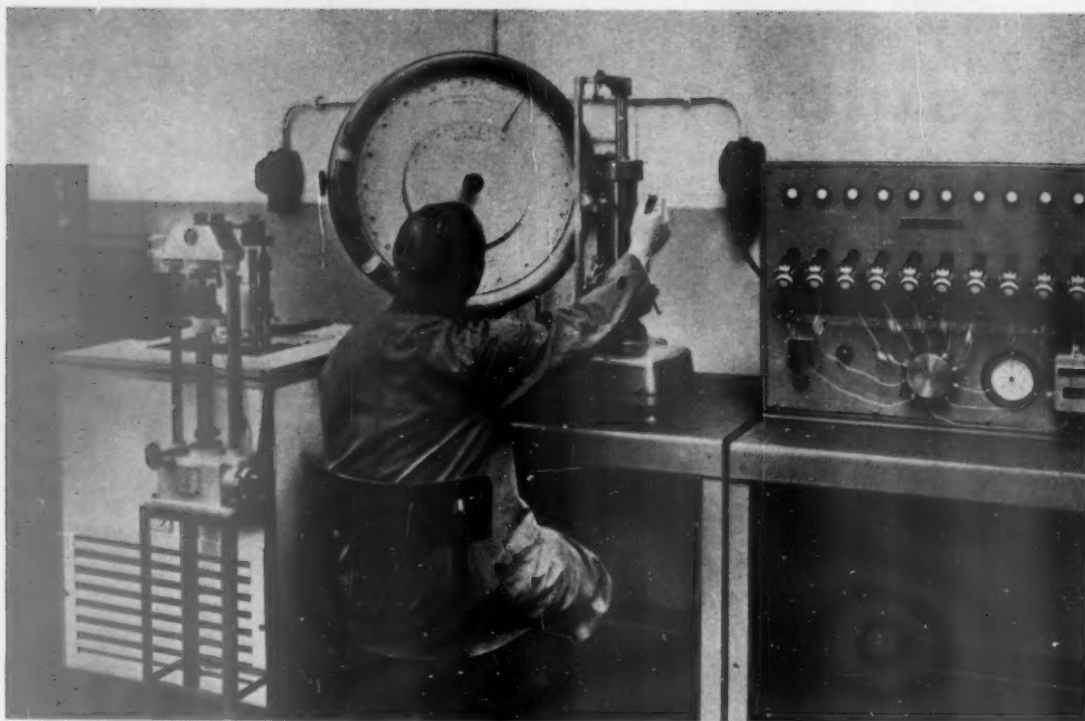
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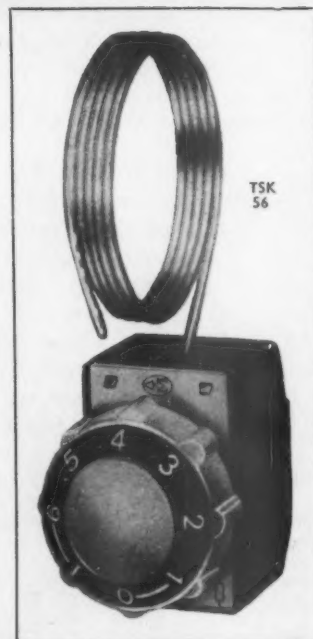
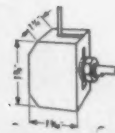
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## Further Commercial News . . .

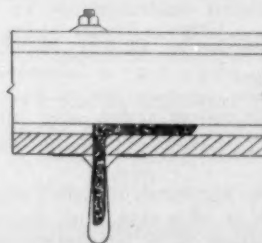
Dr. J. G. Pearce, C.B.E., has been appointed as a consultant to the alloys division of **Union Carbide Ltd., London**, and will work in collaboration with Dr. A. M. Sage and his team in their development programmes. Mr. G. V. Jones, A.I.M., formerly of A.P.V.-Paramount Co. Ltd., has joined the development department of the alloys division of Union Carbide Ltd. He will mainly be concerned with the developments associated with the cast-iron industry.

Sir Graham Cunningham, K.B.E., chairman of **Weldall & Assembly Ltd.**, has announced that an important agreement has been concluded between the company and Fried Steel Equipment Manufacturing Corporation of New York. Licensing arrangements have been granted to Weldall & Assembly Ltd., one of the largest steel fabricators and conveyor specialists in Great Britain (and a member of the Triplex Safety Glass Group) who will manufacture and sell Fried units on a world wide basis with the exception of the Americas and Canada. Fried Steel Equipment, designers and manufacturers of material handling equipment, have developed and patented the Fried "Stripveyor," Fried "Liftveyor" and Fried "Strip Stackers," highly specialized material handling equipment for sheet and plate squaring shears.

Additional paid holidays, over and above the present two weeks, are to be given to a large number of employees of the **Frigidaire Division of General Motors Ltd.** The additional holidays, effective this year, range from one day to one

week according to the status and service of individual employees. In all cases they will be over and above the existing two weeks annual holiday and the normal arrangements regarding public holidays. Employees being granted an extra week will include technical, specialist and senior staff over 25 years of age and with a minimum of one year's service; while employees over 21 years of age in all other grades will be given additional paid leave ranging from one to five days according to service qualifications. Two years ago Frigidaire granted a third week's holiday to all supervisory staff, and in September last year, announced an over-all wage increase for their hourly and weekly paid workers.

A patented spring clip, introduced by the makers of Polyzote insulation board, **Expanded Plastics Ltd.**, enables erection of this insulation to be made more quickly and more easily. The clip which is for use when Polyzote boards are fitted to a roof with angled metal purlins, fits over the vertical of the purlin and teeth on the two flanges of the clip grip the Polyzote board. The board merely has to be cut to size and held in position while the clip is



The new clip for insulation by **Expanded Plastics Ltd.**

slipped on. When fixed by this method, the boards can be as quickly removed when roof repairs or alterations are to be made.

A contract for the insulation of refrigerated spaces on the New Guinea Gulf line ship, **Mary Holt**, has recently been completed by the "**J.D.**" **Insulating Co. Ltd.**, of Bootle, Liverpool. The spaces comprised a range of five domestic chambers having a total capacity of 2,500 c.ft., and five 'tween-deck cargo chambers (including a deep freeze compartment) having a total capacity of 12,500 c.ft. The insulation throughout consisted of "Rocksil" wool faced with "Birmabright" linings to deckheads and all vertical surfaces, and slab cork and reinforced asphalt to the decks. The cargo spaces were air cooled and the company also supplied and fitted the metal delivery and suction trunking, part of which was half buried in the insulation.

A further 4,000 sq. ft. of floor space, has been attached to its premises by **Craig Nicol Ltd.**, refrigeration equipment builders, of Glasgow. This will be used on assembly work and follows a similar floor completed only a year ago. This firm reports a very steady expansion in its trade and excellent prospects for 1960.

## BOOK REVIEW

**THE PRACTICAL ELECTRICIAN'S POCKET BOOK 1960.** 535 pp. Odham's Press Ltd., 6, Catherine Street, London, W.C.2. 7s. 6d.

The 62nd edition of this useful work contains a number of new features and several revisions. Of particular interest is a section on fault finding in refrigerators, and other new sections

include those covering public address systems, semi-conductors (describing the characteristics of new germanium and silicon rectifiers) and storage batteries. Sections are also included for the first time on education in the electrical contraction industry and on Electricity Board tariff structures.

Revision has taken place of sections dealing with protective multiple earthing, electric floor warming, power factor connexion, wiring, and instruments.

Worthy of particular mention is the indexing and reference system which has been adopted by this publication. Answers are easy to find and diagrams, graphs and tabular matter are presented in a useful style.

# Advances in Food Preservation

By W. B. ADAM, M.A., F.R.I.C.

(Continued from December issue)

"The importance of precooling fruit before transport or marketing is being increasingly recognized, the methods used being air blast cooling, hydro-cooling and vacuum cooling. Improvements have been made in the types of insulated vans or containers used for transporting precooled fruit, and there is an increasing tendency to use CO<sub>2</sub> in transporting fresh fruit. The use of solid CO<sub>2</sub> in this case is not associated primarily with the fall in temperature, but rather with inhibitory action on mould growth and on physiological changes in the fruit.

"The capacity of refrigerated gas stores on English farms now amounts to about 12,000,000 c.ft. (equivalent to about 100,000 tons) and is increasing about 4 per cent. per annum. Gas storage is now being used in the U.S.A. and elsewhere, but the emphasis in those countries is placed more on low concentrations of oxygen than on increased concentrations of CO<sub>2</sub>. New substances are available to render stores gas-tight and new methods have been developed to remove excess CO<sub>2</sub> from stores.

"In spite of the advances made in recent years in the practice of refrigerated storage and gas storage, there still remains vast scope for fundamental research in this field.

"It is still impossible accurately to define stage of ripeness, to say exactly at what stage fruit should be picked or to predict storage life or liability to storage disorders from a knowledge of chemical composition or physiological characteristics. Some progress is being made in the study of the effects of orchard treatments on chemical composition and also in the study of the respiration of fruits. The factors which affect the incidence of such physiological storage diseases as 'scald,' 'brown heart,' 'core flush' and low temperature breakdown are still not fully known. Methods for reducing losses from rotting are badly needed. These are some of the problems at present being studied at the Ditton Laboratory in Kent.

"The most striking advances in dehydration in recent years have been in vacuum-drying and freeze-drying. Developments from Danish work led to a

thorough study of vacuum-contact-drying at the Ministry of Agriculture, Fisheries and Food's Research Establishment and Experimental Factory in Aberdeen. In this process the food is placed between hot plates in a vacuum chamber, contact of the upper and lower surfaces of the food with the plates being maintained throughout the drying operation by closing the gap between the plates as the food shrinks. The temperature of the plates falls during the drying cycle from 212° to about 140° F. The studies made in vacuum contact plate drying have led to the development known as accelerated-freeze-drying, which represents the most advanced method of food dehydration known to-day. In this technique the food is frozen and then placed in the vacuum drying chamber (or it may be frozen *in situ* by evaporative cooling under vacuum) and it is then heated by contact with plates above and below. The ice inside the food passes directly from the solid to the vapour phase and is removed from the chamber. By this method meat can be dried in as short a time as five hours, and the products treated in this way reconstitute more rapidly and satisfactorily, with more natural flavour and better stability on storage than is possible by any method used up to now.

"So far as can be ascertained at present the cost of these products should not be more than that of equivalent quantities of quick-frozen foods, and they have the advantage of not requiring low-temperature storage. The process is extremely versatile and can be applied to meat and fish in steak or fillet or minced form, and also to a wide range of vegetables and fruits.

## Irradiation

"During the past few years much energy and resource have been expended in an effort to preserve foods satisfactorily by irradiation. Success has been on a limited scale only, and chiefly confined to pasteurization rather than sterilization, and to the use of irradiation as a supplement to rather than a substitute for other methods of preservation. The

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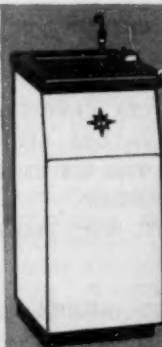
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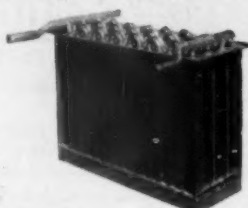


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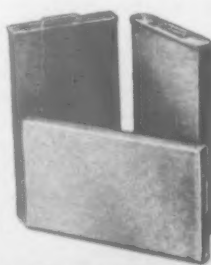
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sources of radiation used are either  $\gamma$ -rays from radioisotopes, or high-energy electrons discharged as a beam from a linear accelerator.

The unit for measuring the dose of ionizing radiation is termed the *rad* and the treatments given can conveniently be classified into three groups—low dose (up to 50,000 rad), medium dose (50,000 to 1,000,000 rad) and high dose (2,000,000 to 5,000,000 rad). The low dose treatments have been used successfully for the suppression of sprouting in potatoes and root crops and for the destruction of insect pests in grain and packaged products. Some success has been obtained with medium dose treatments applied to foods to be stored at temperatures of 0° to 5° C., where the satisfactory storage life has been increased two- to five-fold. High dose treatments of sufficient intensity to produce an acceptable degree of sterility result in undesirable changes in flavour and texture.

Changes in flavour are the most frequent cause of failure of an irradiation process and, in some foods, these changes can occur at doses of less than 100,000 rad. Meat products are reported to develop off-flavours less readily if they have been preheated to destroy enzymes, and vegetables have to be blanched before irradiation for the same reason. Much work has been done on the radiation resistance of bacterial spores and it has been found that the spores of the most dangerous food-poisoning organism, *Clostridium botulinum*, require about 400,000 rad to reduce their concentration to one-tenth. If it is agreed that the same degree of sterility is required for irradiated as for canned foods, and that the acceptable risk is of the order of one in  $10^{13}$ , then the dose necessary to produce this factor of safety is nearly 5,000,000 rad; half this dose is sufficient protection against other micro-organisms. At the moment there is little prospect that foods can be sterilized with doses much below these figures, or that the undesirable changes in flavour and texture resulting from such drastic treatment can be materially reduced. Nevertheless, work on irradiation of foods continues on an increasing scale in universities and research institutes throughout the world, and in particular, in the U.S.A. In Britain progress is being made in this field by the United Kingdom Atomic Energy Isotope Division at Wantage and by the Low Temperature Research Station at Cambridge.

"Evidence obtained up to now suggests that irradiated foods are quite harmless, but it might take some time to convince the public of this fact and persuade them to accept foods preserved in this way. Quite apart from economic considerations it seems improbable that foods sterilized by irradiation will compete with canned or frozen foods in the foreseeable future.

#### Antibiotics

"The use of antibiotics as food additives is not permitted at the present time in Great Britain; however, some relaxation of the regulations may be expected before long. The most important of the antibiotics under investigation can be placed in two groups (a)

those which are not used therapeutically, and (b) those which are used for the treatment of disease. Nisin and subtilin may be included in the first group, aureomycin and terramycin in the second.

"Nisin occurs naturally in some cheeses and is used in several countries to prevent bacterial growth in cheese. Studies made at the Campden Research Station have shown that the addition of very small quantities of nisin to canned vegetables can inhibit the germination and growth of spores of thermophilic bacteria and afford protection against possible souring of products when stored at high temperatures. The antibiotic would not be relied upon to control the growth of pathogenic organisms in canned vegetables, though it could be expected to afford this protection as well. Experiments made in the U.S.A. have shown that subtilin acts in a very similar manner to nisin.

"Aureomycin and terramycin have no action on yeasts or moulds but can control the growth of a wide range of bacteria. In some countries (including the U.S.A.) these antibiotics are permitted for the treatment of eviscerated poultry, and an increase of up to 50 per cent. in storage life has resulted from their use in the iced cooling water in which the birds are washed. Much heavier additions of the antibiotics to modified feeds given to poultry 48 hours before slaughter can result in a substantial reduction in spoilage on subsequent storage under warm conditions. Treatment of this sort is permitted under existing British regulations as it is considered to be part of the feeding-stuff and not an added preservative.

"Experiments on the spraying or injection of meats with antibiotics have been successful in prolonging storage life, but no methods for commercial use have yet been approved. Antibiotics have also been used with some success in experiments on the control of deep spoilage of whales before processing and have been found to be beneficial when added to the iced water in which fish are stored soon after the catch.

"Work on the use of antibiotics in foods is in progress at several research laboratories in the United Kingdom, including the Low Temperature Research Station at Cambridge and the Torry Research Station at Aberdeen.

#### Conclusions

"It has not been possible, in the limited time available for this lecture, adequately to deal with all aspects of recent research and development in the preservation of food, but merely to indicate the main lines of advance. Canning and quick-freezing continue to increase in popularity and remain the chief methods used for long-term storage of foods. Refrigerated storage and refrigerated gas storage are so commonly accepted as a part of the everyday management of our daily food supply that they are easily overlooked or underrated in a review such as this. A method of preservation about which more will undoubtedly be heard in the near future is dehydration by accelerated-freeze-drying, and there may well be advances in the uses of antibiotics and

in the pasteurization of foods by means of irradiation.

"At the beginning of this lecture it was stated that the aim in developing any new method of preservation should be to produce an article which could be prepared with ease and eaten with safety, benefit and enjoyment. The need to fulfil the first of these is the more evident through the changing pattern of the duties of the modern housewife in her kitchen. The safety of the foods is guaranteed if the manufacturer makes use of the processes recommended by his research association and, in the case of quick-frozen foods, if the retailer ensures that the conditions of storage and sale are correct. A vast amount of research has gone into the problem of preserving foods so as to retain their full nutritive value and it is now possible to retain a high vitamin content in foods preserved by canning, quick freezing or drying. Finally, it must be emphasized that foods have not only to be eaten but also enjoyed, and a major task of the food manufacturer must be to present his products in an attractive way and ensure that the flavour as well as the appearance will meet with the approval of the consumer.

"It is 151 years since Thomas Saddington described to this society a method of preserving fruit in bottles by means of heat, even assuring them that, if they had not 'an instrument for recording the temperature' of the water used for processing, they could use their finger to gauge the heat. In surveying the advances which have been made since his day one can hopefully echo the claim he made for his own preserved fruits, that they would prove to be of 'general utility and luxurious benefit' to mankind."

## Refrigeration Patents

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the official "Journal of Patents," and are published by permission of the Controller of H.M. Stationery Office.

### APPLICATIONS RECEIVED

October 1—Robertson Thain Ltd. (Robertson Co., H. H.), C33336, C33337, Air-conditioning systems. 7—Svenska Flaktfabriken A.B., and Svenska Turbin A.B., Ljunstrom, C34016, Air-conditioning holds system. 9—Bolinder's Fabriks A.B., C34324, Absorption refrigerating apparatus. 14—Aerosol Corporation T.R., C34777, Air-conditioning method, etc.; Celleco A.B., C34745, Refrigerating systems heat transfer method, etc.; Philips Electrical Industries Ltd., C34839, Deep-frozen substances thawing devices. 15—English Electric Co. Ltd., Shone, K. A., P34960, Refrigeration systems. 20—Ellis, B. C., and Henry, A., P35432, Air-conditioning equipment; Thorne & Son Ltd., J. B. Thorne, J., and Thorne, J. B., P35500, Air-conditioning system. 23—Gidley, K. E., P36036, Air-conditioned structures.

December 7—United Aircraft Corporation, C41485, Refrigerating systems control apparatus. 10—Carrier Engineering Co. Ltd. and Gilbert, D., P42049, Air-

conditioning systems. 11—Bayston, J. R. Kuebler, T. L., C42295, Ice-making machine; General Motors Corporation, C42173, Refrigerator; Hoyer, O. G., C42273, Refrigerators freezing cells liquid, etc. material filling apparatus; Ruchpaul, K., P42230, Refrigerators. 14—Ranco Inc. Leibermann, J., C42377, Refrigeration control apparatus. 15—Linde's Eismaschinen A.G. Ges fur, C42587, Refrigeration installations; Whirlpool Corporation, C42630, Ice-making machines. Guhl, A., C43701, Room air-conditioning process.

### COMPLETE SPECIFICATIONS ACCEPTED

October 28—McFarlan, A. I., 826,072, Air-conditioning system; Carrier Engineering Co. Ltd., 826,111, Absorption refrigeration systems.

December 16—Siemens-Schuckertwerke, A. G., 827,747, Absorption refrigerators. 23—English Electric Co. Ltd., 828,064, Refrigerators. 31—Pellizzetti, I., 828,979, Air-conditioner. January 6—Renisoff, A. C., 829,483, Refrigerated tanks; Denisoff, A.C., 829,484, Refrigeration apparatus.

The First Lord of the Admiralty has approved the appointment of Mr. P. T. Williams to be director of navy contracts in succession to Mr. B. Pool, C.B., C.B.E., who is retiring. The appointment took effect on February 1. Mr. Williams who lives in Loughton, Essex, is 52 years of age and was born at Cheltenham. He entered Admiralty service as assistant surveyor in 1931 and afterwards served in various grades at Chatham, Hong Kong, and Portsmouth before promotion to principal in 1948. He was promoted to assistant secretary in 1956 and is at present serving as head of general finance, branch I, at Admiralty.

Two films "The Principles of the Gas Refrigerator" and "The Use of the Gas Refrigerator" are included in a number which can be obtained on free loan from the Gas Council Film Library, 1, Grosvenor Place, London, S.W.1. The Council's new film catalogue is available free of charge on application to the library.

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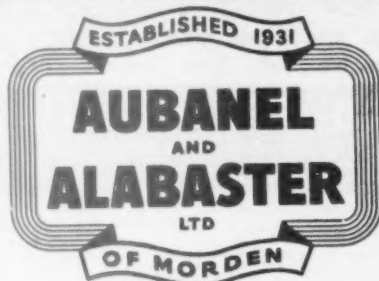
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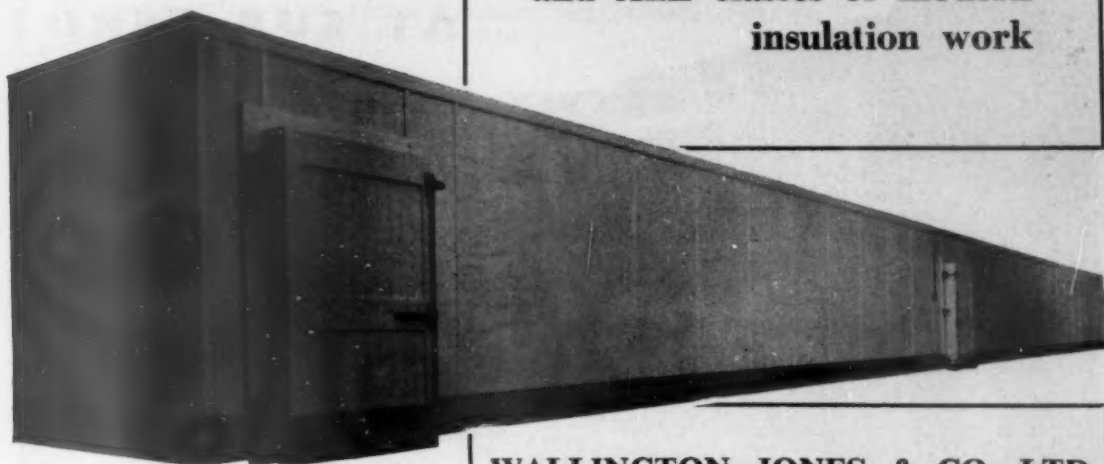
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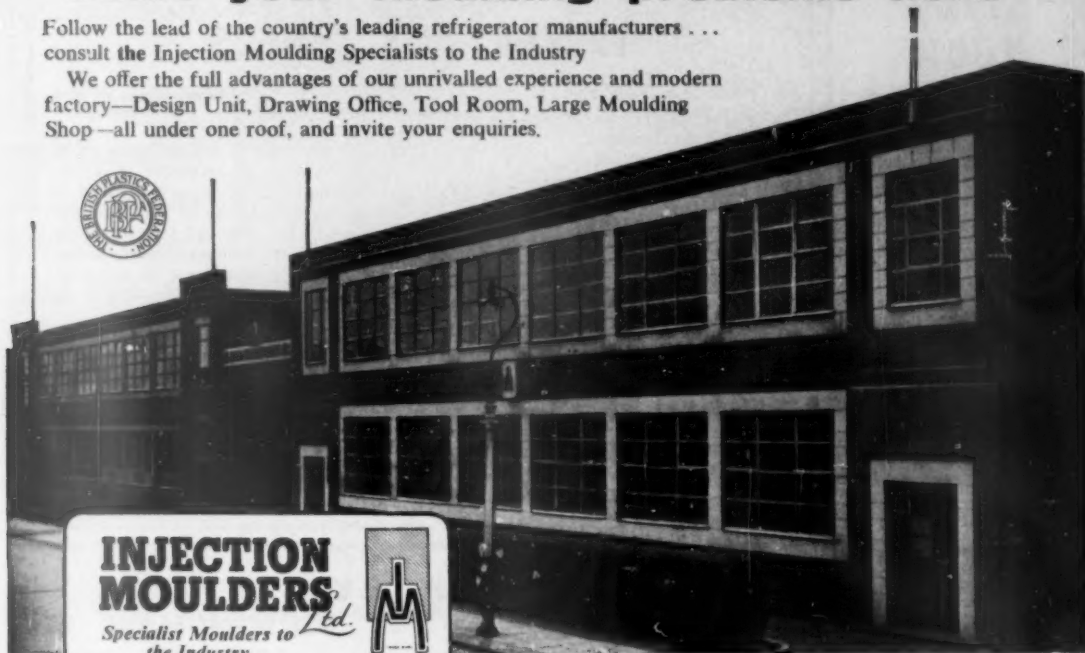
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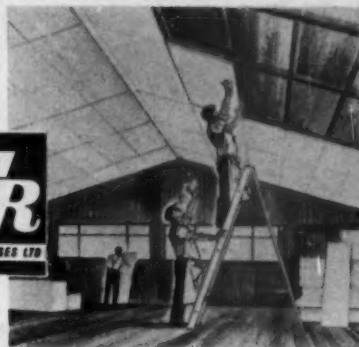
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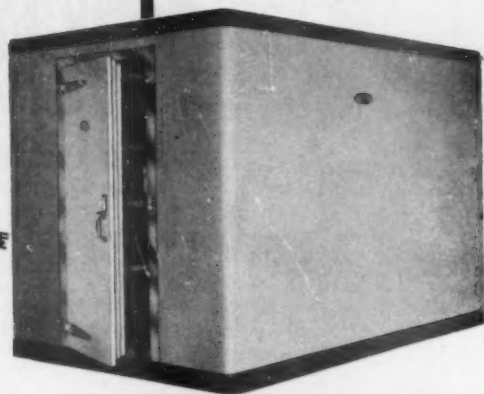
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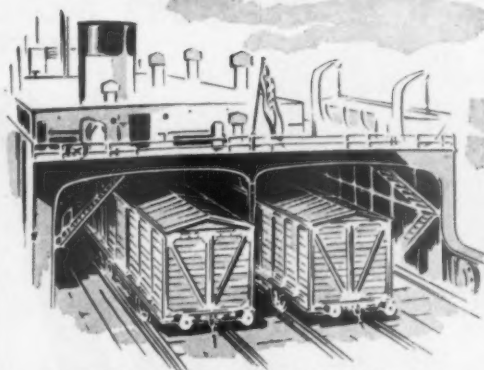
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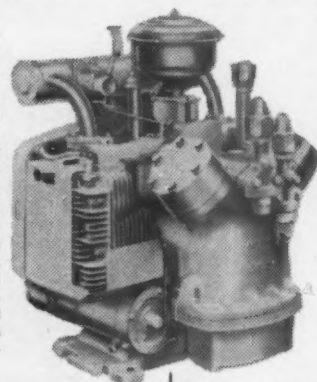
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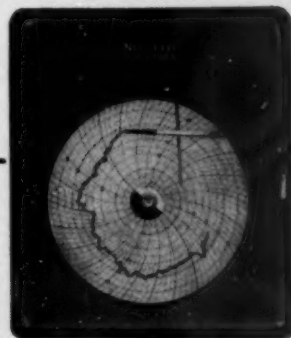
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Examples  
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controls



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Evaporator Thermostats



Brine and Room Thermostats



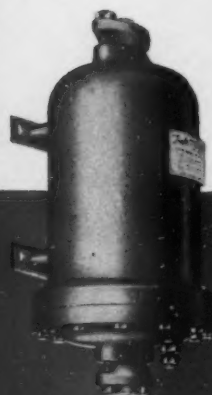
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